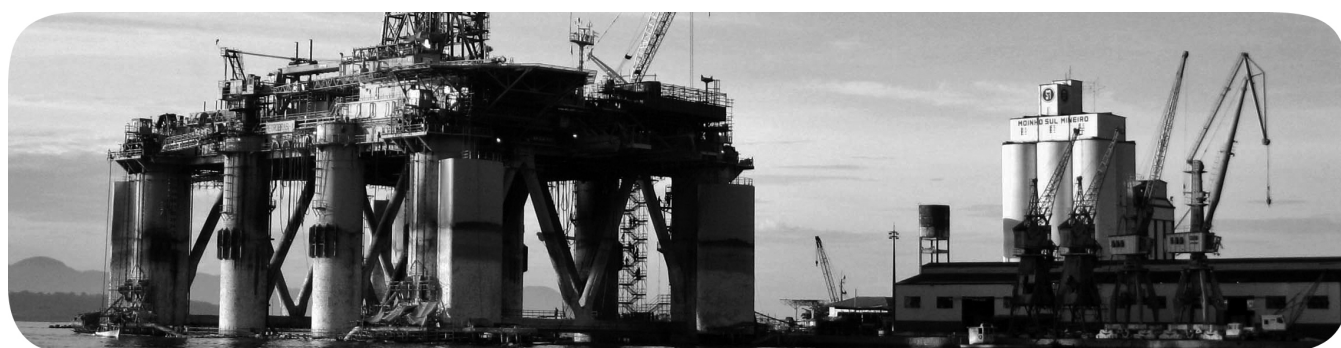


EC4 Current Monitoring Relay

Catalog Number 193-EC4



Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication [SGL-1.1](#) available from your local Rockwell Automation sales office or online at <http://www.rockwellautomation.com/literature/>) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.



WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence



SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.



BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

IMPORTANT Identifies information that is critical for successful application and understanding of the product.

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Manual Objectives

The purpose of this manual is to provide you with the necessary information to apply the EC4 Current Monitoring Relay with DeviceNet communications. Described in this manual are methods for installing, configuring, and troubleshooting.

IMPORTANT Read this manual in its entirety before installing, operating, servicing, or initializing the EC4 Current Monitoring Relay.

Who Should Use This Manual

This manual is intended for qualified personnel responsible for setting up and servicing these devices. You must have previous experience with and a basic understanding of communications technology, configuration procedures, required equipment, and safety precautions.

To make efficient use of the EC4 Current Monitoring Relay, you must be able to program and operate devices with communications and have a basic understanding of the EC4 Current Monitoring Relay's parameter settings and functions. You should also understand DeviceNet network operations, including how slave devices operate on the network and communicate with a DeviceNet master.

Conventions

Parameter names are shown in italic typeface.

Reference Manuals

For SLC 500 and 1747-SDN information:

- *DeviceNet Scanner Module Installation Instructions* Publication 1747-IN058E-EN-P
- *DeviceNet Scanner Module User Manual* Publication 1747-UM655B-EN-P

For PLC5 and 1771-SDN information:

- *DeviceNet Scanner Module Installation Instructions* Publication 1771-5.14
- *DeviceNet Scanner Module Configuration Manual* Publication 1771-6.5.118

For MicroLogix/CompactLogic and 1769-ADN information:

- *DeviceNet Module Installation Instructions* Publication 1769-IN001B-EN-P
- *DeviceNet Module User Manual* Publication 1769-UM001B-EN-P

For ControlLogic and 1756-DNB information:

- *DeviceNet Module Installation Instructions* Publication 1756-IN566C-EN-P
- *DeviceNet Module User Manual* Publication DNET-UM004A-EN-P

To install and implement a DeviceNet network:

- *DeviceNet Media Design and Installation Guide* Publication
DNET-UM072_-EN-P

IMPORTANT Read the *DeviceNet Media Design and Installation Guide*, Publication DNET-UM072_-EN-P, in its entirety before planning and installing a DeviceNet system. If the network is not installed according to this document, unexpected operation and intermittent failures can occur. If this manual is not available, please contact either the local Rockwell Automation Distributor or Sales Office and request a copy. Electronic copies may also be obtained via the Internet or from the Allen-Bradley Home Page at "www.ab.com".

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Product Overview

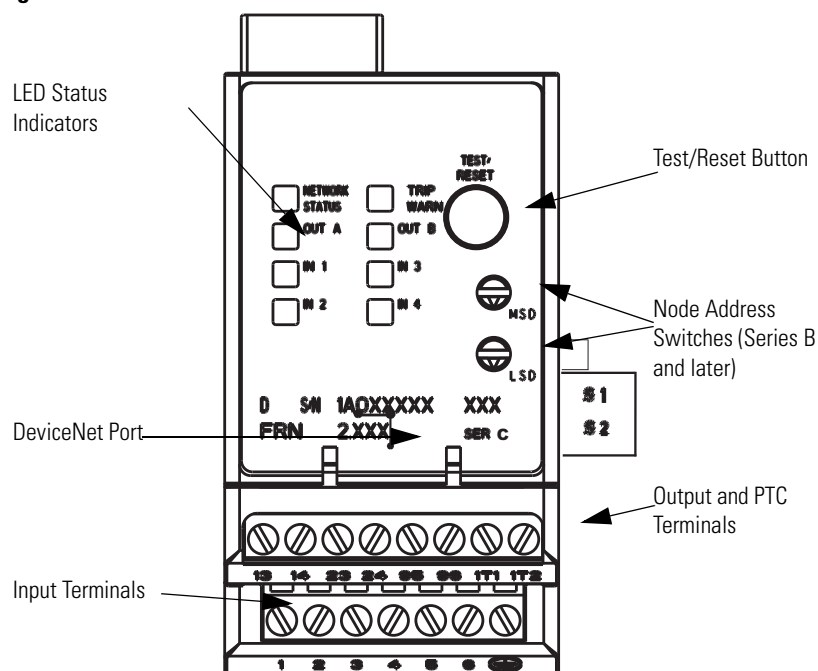
Introduction

This chapter provides a brief overview of the features and functionality of the EC4 Current Monitoring Relay.

Description

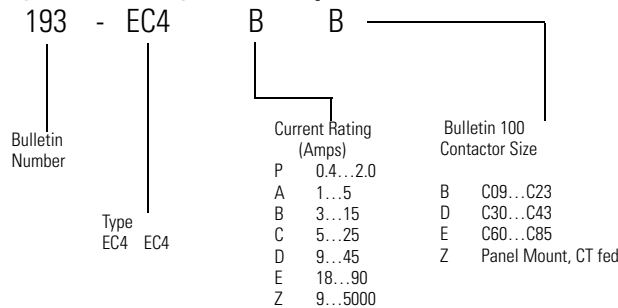
The EC4 Current Monitoring Relay is a multi-function solid-state microprocessor-based electronic current monitoring relay for loads rated from 0.4...5000 A.

Figure 1 - EC4 Feature Overview



Catalog Number Explanation

Figure 2 - Catalog Number Explanation



Single-/Three-Phase Operation

The EC4 Current Monitoring Relay is factory-programmed to monitor three-phase current. The installer can easily change to single-phase operation by accessing and changing the setting of Parameter 27, *Single/Three Ph*. Refer to **Chapter 2 — Installation and Wiring** – for typical motor connections.

Protection and Warning Functions

The EC4 Current Monitoring Relay provides the following protection and warning functions:

- L(1-3) Undercurrent
- L(1-3) Overcurrent
- L(1-3) Loss
- Communication Fault/Idle
- Number of Starts (warning only)
- Number of Hours (warning only)

Refer to **Chapter 3 — Protective Trip and Warning Functions** and **Chapter 5 — Programmable Parameters** for further explanation of these functions.

Current Monitoring Parameters

The EC4 Current Monitoring Relay allows the user to monitor the following operational data over the DeviceNet network:

- Individual phase currents (in amperes)
- Ground fault current (in amperes)

Refer to **Chapter 6 — Current Monitoring Parameters** for further information.

Diagnostic Parameters

The EC4 Current Monitoring Relay allows the user to monitor the following diagnostic information over the DeviceNet network:

- Device status
- Trip status
- Warning status
- Elapsed Time
- Operating Hours
- History of past 5 trips and warnings

Refer to **Chapter 7 — Diagnostic Parameters** for detailed information of these parameters.

Trip Relay

When the EC4 Current Monitoring Relay is in the unpowered state, the trip relay contact is open. The trip relay contact closes approximately 2.35 seconds after power is applied if no trip condition exists.

Inputs and Outputs

In addition to the trip relay, the EC4 Current Monitoring Relay provides 4 inputs and 2 outputs. the inputs are rated 24V DC only. For 120V AC inputs, add the AC input interface module, Cat. No. 193-EIMD

The status of each can be monitored over the DeviceNet network through parameter 21, *Device Status*, or one of the input assemblies. Additionally, the outputs can be controlled over the network by using one of the output assemblies. Refer to Appendix B — DeviceNet Information for listings of the available input and output assemblies.

The EC4 Current Monitoring Relay offers added flexibility by providing the capability to perform control functions with the inputs and outputs through DeviceLogix.

The EC4 Current Monitoring Relay inputs are independently configurable for Trip Reset, Remote Trip, L1 Loss Arm, L2 Loss Arm, L3 Loss Arm, L1L2 Loss Arm, L2L3 Loss Arm, L1L3 Loss Arm, L1L2L3 Loss Arm, and normal operation.



ATTENTION: If the outputs are being commanded via an explicit message, ensure that there is no established I/O connection that is actively controlling them, and that the explicit message connection has a non-zero expected packet rate (EPR) setting.



ATTENTION: The state of the outputs during a Protection Fault, DeviceNet Comm Fault, or a DeviceNet Comm Idle may be dependent on the OUTA or OUTB Pr FltState, Pr FltValue, Dn FltState, Dn FltValue, Dn IdlState, and Dn IdlValue programmable parameters. For details refer to the *Output Setup Group* section of **Chapter 5 – Programmable Parameters**.



ATTENTION: The EC4 Current Monitoring Relay's output control firmware latches "OUT A" and "OUT B" closed upon receipt of a network "close" command. The outputs will maintain the commanded closed state until receipt of a network "open" command. Parameters "OutX Pr FltState" and "OutX Pr FltValue", found in the EC4 Current Monitoring Relay's Output Setup group, allow flexibility concerning the operation of the outputs in the event of a trip. **Factory default settings cause the outputs to open upon occurrence of a trip. EC4 outputs that were closed prior to a trip will re-close upon trip reset, provided that a network "open" command is not received first.**

Status Indication

The EC4 Current Monitoring Relay provides the following LED indicators:

☐ NETWORK STATUS	☐ TRIP / WARN
☐ OUT A	☐ OUT B
☐ IN 1	☐ IN 3
☐ IN 2	☐ IN 4

NETWORK STATUS: This green/red LED indicates the status of the network connection. See **Chapter 11 — Troubleshooting** for the possible LED indications and the associated definitions.

TRIP / WARN: This red/amber LED flashes an amber code under a warning condition and a red code when tripped. The warning or trip code is indicated by the number of flashes in sequence. Refer to the side label on the product for trip/warning codes or **Chapter 11 — Troubleshooting**.

OUT A and B: These amber LEDs illuminate when the output contacts are commanded closed.

IN 1...4: These amber LEDs illuminate when the user-connected device contact is closed.

Test/Reset Button

The Test/Reset button located on the front of the EC4 Current Monitoring Relay allows the user to perform the following:

Test: If *Test Enable* is enabled, the trip relay contact will open if the EC4 Current Monitoring Relay is in an un-tripped condition and the Test/Reset button is pressed. The Test/Reset button must be pressed for a minimum of 2 seconds to activate the test function.

Reset: The trip relay contact will close if the EC4 Current Monitoring Relay is in a tripped condition, the cause of the trip is no longer present, and the Test/Reset button is pressed.



ATTENTION: The “Test” function associated with the Test/Reset button is enabled by default. Activating it while a motor is operating will cause the starting contactor to drop out and stop motor operation.

Node Address Switches

The node address switches located on the front of the EC4 Current Monitoring Relay provides physical means for setting the device node address value. Switch settings greater than 63 allow the node address to be software configured.

DeviceNet Compatibility

The EC4 Current Monitoring Relay supports the following DeviceNet functionality:

- Polled I/O messaging
- Change-of-state / cyclic messaging
- Explicit messaging
- Group 4 off-line node recovery messaging
- Full parameter object support
- Auto-baud rate identification
- Configuration consistency value
- UCMM (Unconnected Message Manager)
- DeviceLogix component technology

Flash Memory

The EC4 Current Monitoring Relay incorporates flash memory. This facilitates updating of the product firmware as new revisions are released.

Installation and Wiring

Introduction

This chapter provides instructions for receiving, unpacking, inspecting, and storing the EC4 Current Monitoring Relay. Installation and wiring instructions for common applications are also included.

Receiving

It is the responsibility of the user to thoroughly inspect the equipment before accepting the shipment from the freight company. Check the item(s) received against the purchase order. If any items are damaged, it is the responsibility of the user not to accept delivery until the freight agent has noted the damage on the freight bill. Should any concealed damage be found during unpacking, it is again the responsibility of the user to notify the freight agent. The shipping container must be left intact and the freight agent should be requested to make a visual inspection of the equipment.

Unpacking/Inspecting

Remove all packing material from around the EC4 Current Monitoring Relay. After unpacking, check the item's nameplate catalog number against the purchase order.

Storing

The EC4 Current Monitoring Relay should remain in its shipping container prior to installation. If the equipment is not to be used for a period of time, it must be stored according to the following instructions in order to maintain warranty coverage:

- Store in a clean, dry location.
- Store within an ambient temperature range of -40°C...+85°C (-40°...+185°F).
- Store within a relative humidity range of 0...95%, non-condensing.
- Do not store where the device could be exposed to a corrosive atmosphere.
- Do not store in a construction area.

General Precautions

In addition to the specific precautions listed throughout this manual, the following general statements must be observed.



ATTENTION: The EC4 Current Monitoring Relay contains ESD (electrostatic discharge) -sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing, or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, refer to Allen-Bradley publication 8200-4.5.2, "*Guarding Against Electrostatic Damage*", or any other applicable ESD protection handbook.



ATTENTION: An incorrectly applied or installed EC4 Current Monitoring Relay can result in damage to the components or reduction in product life. Wiring or application errors, such as supplying incorrect or inadequate DeviceNet supply voltage, connecting an external supply voltage to the input, or operating/storing in excessive ambient temperatures may result in malfunction of the EC4 Current Monitoring Relay.



ATTENTION: Only personnel familiar with the EC4 Current Monitoring Relay and associated machinery should plan to install, start up, and maintain the system. Failure to comply may result in personal injury and/or equipment damage.



ATTENTION: The purpose of this user manual is to serve as a guide for proper installation. The National Electrical Code and any other governing regional or local code will overrule this information. Rockwell Automation cannot assume responsibility for the compliance or proper installation of the EC4 Current Monitoring Relay or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.



ATTENTION: The Earth Ground terminal of the EC4 Current Monitoring Relay shall be connected to a solid earth ground via a low-impedance connection.

Starter Installation

The following figures and tables illustrate the starter assembly instructions and approximate dimensions.

Starter Assembly Instructions

Figure 3 - 100-C09...C43 Starter Assembly Instructions (for use with Cat. Nos. 193-EC__B and -EC__D)

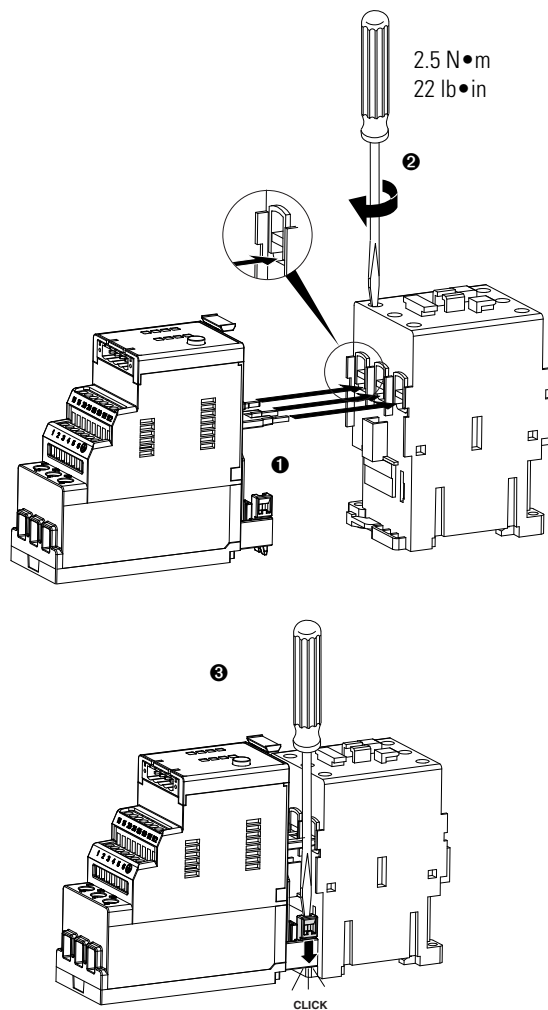
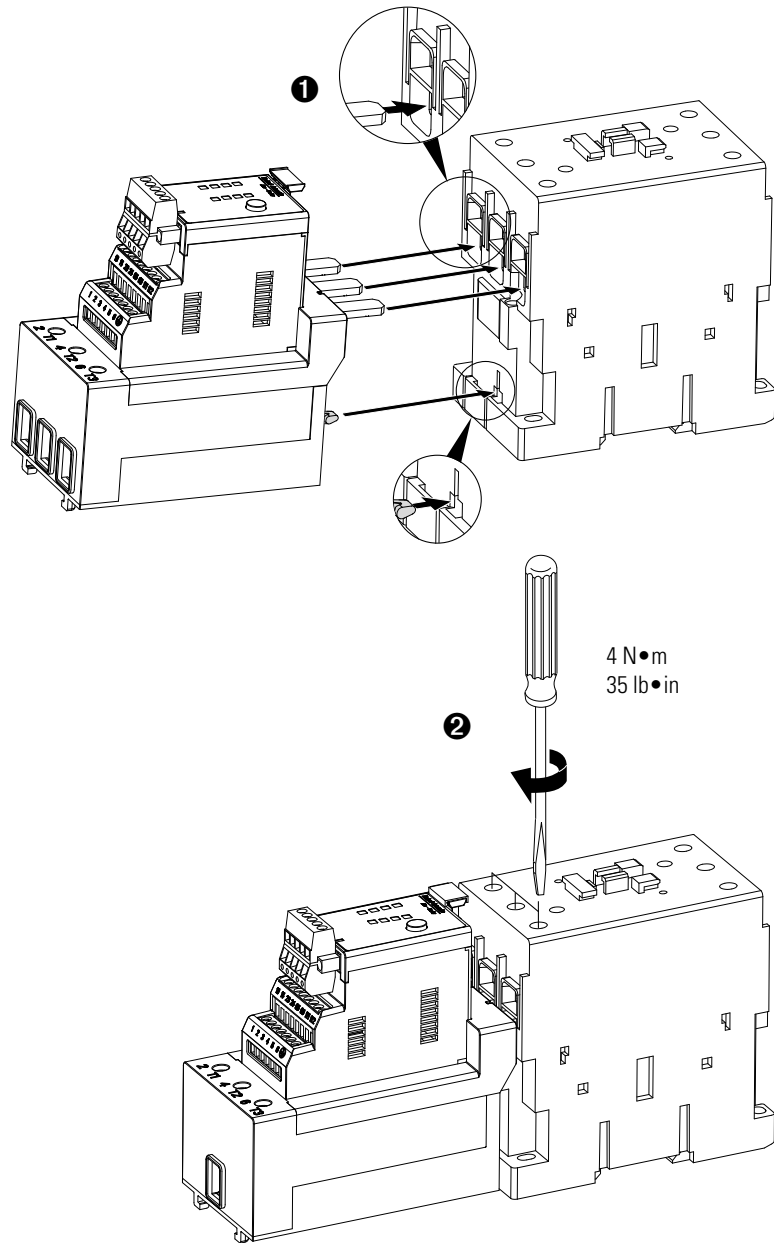


Figure 4 - 100-C60...C85 Starter Assembly Instructions (for use with Cat. No. 193-EC__E)



Starter Approximate Dimensions

Approximate dimensions are shown in millimeters (inches). Dimensions are not intended to be used for manufacturing purposes.

Figure 5 - Bulletin 109 Approximate Starter Dimensions

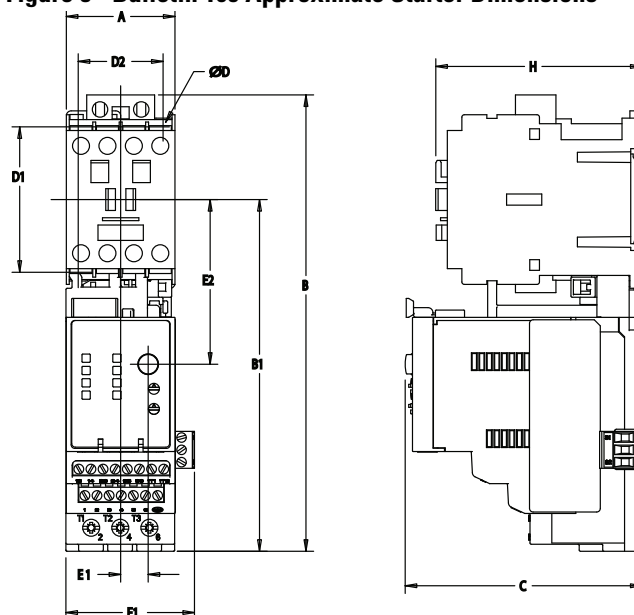


Table 1 - Bulletin 109 Approximate Starter Dimensions

Overload Cat. No.	Contactor Cat. No.	Width A	Height B		B1	Depth C	E1	E2
			without 193-EIMD	with 193-EIMD				
193-EC__B	100-C09, -C12 -C16, -C23	45 (1-25/32)	188.3 (7-13/32)	207.7 (8-11/64)	145.1 (5-23/32)	107 (4-7/32)	11.4 (29/64)	67.9 (2-43/64)
193-EC__D	100-C30, -C37	45 (1-25/32)	188.3 (7-13/32)	207.7 (8-11/64)	145.1 (5-23/32)	107 (4-7/32)	11.4 (29/64)	67.9 (2-43/64)
193-EC__D	100-C43	54 (2-1/8)	188.3 (7-13/32)	207.7 (8-11/64)	145.1 (5-23/32)	107 (4-7/32)	11.4 (29/64)	67.9 (2-43/64)
193-EC__E	100-C60, -C72, -C85	72 (2-53/64)	236.1 (9-19/64)	255.5 (10-1/16)	173.2 (6-13/16)	124.6 (4-29/32)	11.4 (29/64)	89.8 (3-17/32)
Overload Cat. No.	Contactor Cat. No.	F1	D1	D2	H	J	ØD	
193-EC__B	100-C09, -C12 -C16, -C23	53.2 (2-3/32)	60 (2-23/64)	35 (1-3/8)	85.1 (3-23/64)	2 (5/64)	Ø4.2 (11/64Ø)	
193-EC__D	100-C30, -C37	53.2 (2-3/32)	60 (2-23/64)	35 (1-3/8)	104 (4-3/32)	2 (5/64)	Ø4.2 (11/64Ø)	
193-EC__D	100-C43	62.2 (2-7/16)	60 (2-23/64)	45 (1-25/32)	107 (4-7/32)	2 (5/64)	Ø4.2 (11/64Ø)	
193-EC__E	100-C60, -C72, -C85	80.2 (3-9/64)	100 (3-15/16)	55 (2-11/64)	125.5 (4-15/16)	2 (5/64)	Ø5.5 (7/32Ø)	

Separate Mount Adapter Approximate Dimensions

Approximate dimensions are shown in millimeters (inches). Dimensions are not intended to be used for manufacturing purposes.

Figure 6 - 193-ECPM1 Panel Mount Adapter Approximate Dimensions (for use with Cat. No. 193-EC__B)

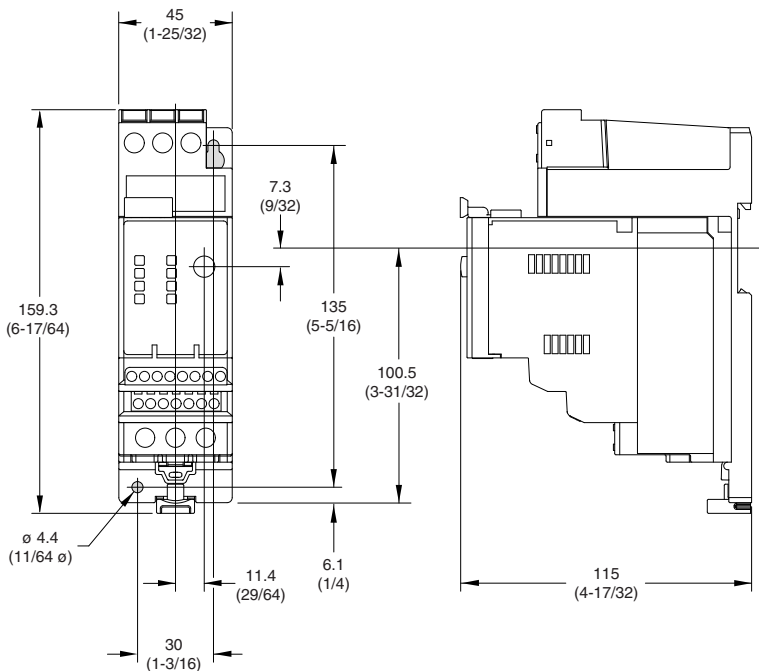


Figure 7 - 193-ECPM2 Panel Mount Adapter Approximate Dimensions (for use with Cat. No. 193-EC__D and 193-EC__Z)

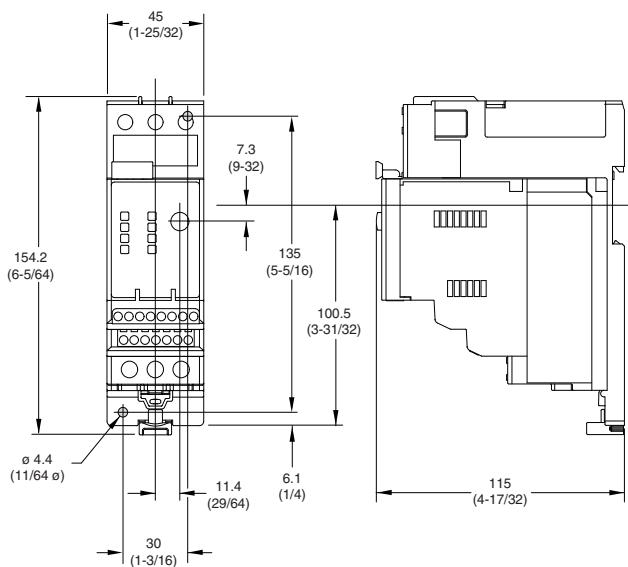


Figure 8 - 193-ECPM3 Panel Mount Adapter Approximate Dimensions (for use with Cat. No. 193-EC__E)

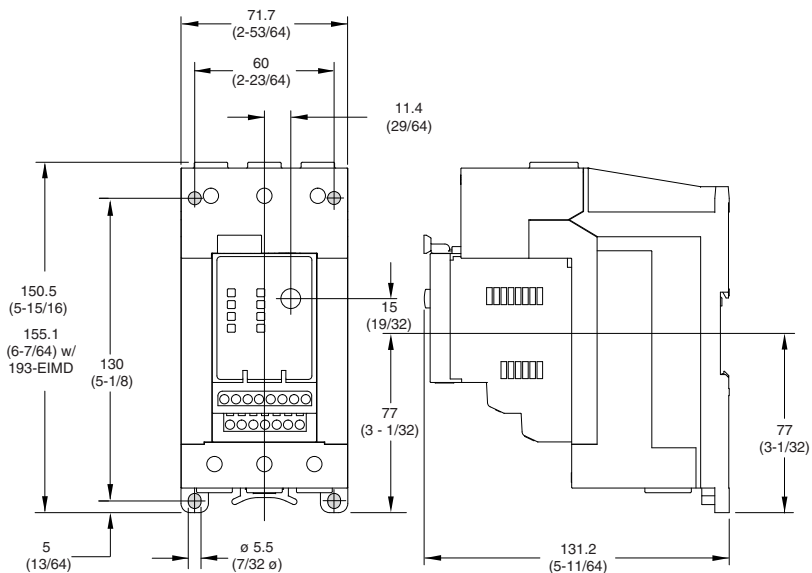
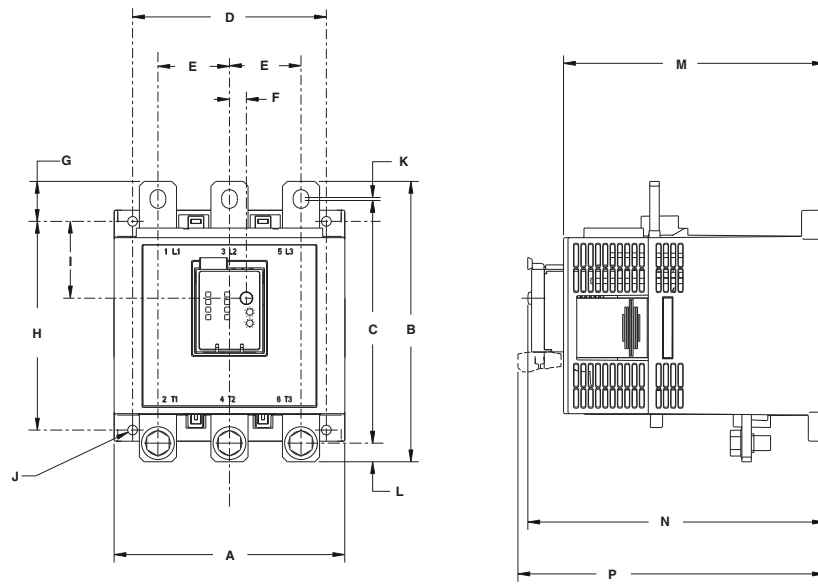


Figure 9 - Wire Size and Torque Specifications

Power Terminals

Table 2 - Power Terminal Wire Size and Torque Specification

	Cat. No.	193-EC__B, -EC__D	193-EC__E
Stranded/Solid AWG	Single Conductor	#14...6 AWG	#12...1 AWG
	Torque	22 lb-in	35 lb-in
Flexible-Stranded with Ferrule Metric	Multiple Conductor	#10...6 AWG	#6...2 AWG
	Torque	30 lb-in	35 lb-in
Flexible-Stranded with Ferrule Metric	Single Conductor	2.5...16 mm ²	4...35 mm ²
	Torque	2.5 N•m	4 N•m
Coarse-Stranded/Solid Metric	Multiple Conductor	6...10 mm ²	4...25 mm ²
	Torque	3.4 N•m	4 N•m
Coarse-Stranded/Solid Metric	Single Conductor	2.5...25 mm ²	4...50 mm ²
	Torque	2.5 N•m	4 N•m
Coarse-Stranded/Solid Metric	Multiple Conductor	6...16 mm ²	4...35 mm ²
	Torque	3.4 N•m	4 N•m

Control and DeviceNet Terminals

Table 3 - Control and DeviceNet Terminal Wire Size and Torque Specification

	Cat. No.	All Types
Stranded/Solid AWG	Single Conductor Multiple Conductor Torque	24...12 AWG 24...16 AWG 5 lb-in
Flexible-Stranded with Ferrule Metric	Single Conductor Multiple Conductor Torque	0.25...2.5 mm ² 0.5...0.75 mm ² 0.55 Nm
Coarse-Stranded/Solid Metric	Single Conductor Multiple Conductor Torque	0.2...4.0 mm ² 0.2...1.5 mm ² 0.55 Nm

Table 4 - Maximum Wire Lengths (Input)

Min. Cross Section	mm ²	0.5	0.75	1.5	2.5	4.0
	AWG	20	18	16	14	12
Max. Length ❶	m	160	250	400	600	1000
	ft	525	825	1300	1950	3200

For reliable input signal processing, input wiring should be routed in raceways separate from power cabling.

Table 5 - Ground Fault Sensor Terminals (S1 and S2)

Wire type	Shielded, twisted pair
Cross section	0.2...4.0 mm ² (#24...12 AWG)
Torque	0.55 N•m (5 lb-in.)

Terminal Designations

Control Terminals

The following table defines the EC4 Current Monitoring Relay control terminal designations.

Table 6 - Control Terminal Designation

Terminal Designation	Reference	Description
1	IN 1	General-purpose sinking input number 1
2	IN 2	General-purpose sinking input number 2
3	IN 3	General-purpose sinking input number 3
4	IN 4	General-purpose sinking input number 4
5	V+	+24V DC supply for inputs
6	V+	
	End	Earth Ground ❶
13/14	OUT A	Output A
23/24	OUT B	Output B

Table 6 - Control Terminal Designation

Terminal Designation	Reference	Description
95/96	Trip Relay	Trip Relay
IT1/IT2	—	—
S1/S2	—	External ground fault sensor input

- ❶ An earth ground connection to this terminal will assist in obtaining compliance with Electromagnetic Compatibility requirements.

DeviceNet Terminals

The following table defines the DeviceNet connector terminal designations.

Table 7 - DeviceNet Terminal Designation

Terminal	Signal	Function	Color
1	V-	Common	Black
2	CAN_L	Signal Low	Blue
3	Drain	Shield	Non-insulated
4	CAN_H	Signal High	White
5	V+	Power Supply	Red

Grounding

The following grounding recommendations are provided to ensure Electromagnetic Compatibility compliance during installation:

- The earth ground terminal of the EC4 Current Monitoring Relay shall be connected to a solid earth ground via a low-impedance connection
- Installations employing an external ground fault sensor shall ground the cable shield at the sensor with no connection made at the EC4 Current Monitoring Relay

Short-Circuit Ratings

The EC4 Current Monitoring Relay is suitable for use on circuits capable of delivering not more than the RMS symmetrical amperes listed in the following tables.

Table 8 - UL Short-Circuit Ratings

Cat. No.	Maximum Available Fault Current [A]	Maximum Voltage [V]
193-EC__B	5,000	600
193-EC__D	5,000	600
193-EC__E	10,000	600
193-EC__Z	5,000	600

Table 9 - IEC Short-Circuit Ratings

Cat. No.	Prospective Current I_r [A]	Conditional Short Circuit Current I_q [A]	Maximum Voltage [V]
193-EC__B	1,000	100,000	690
193-EC__D	3,000	100,000	690
193-EC__E	5,000	100,000	690

Fuse Coordination

The following table illustrates the Type I and Type II fuse coordination when used in conjunction with Bulletin 100-C contactors.

Table 10 - Type I and Type II Fuse Coordination with 100-C and 100-D Contactors

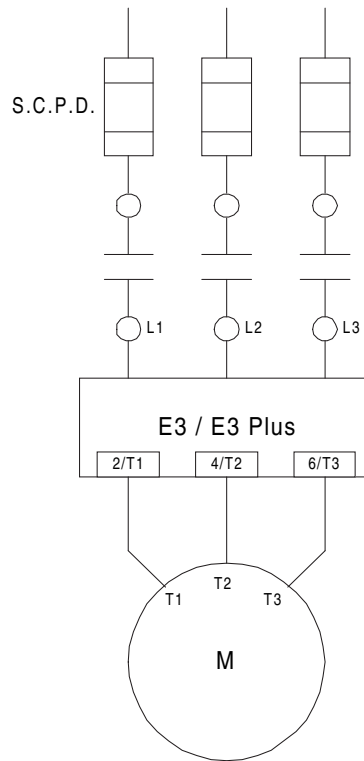
Overload Cat. No.	Contactor Cat. No.	Prospective Current I_r [A]	Conditional Short Circuit Current I_q [A]	Type I Class J or CC [A]	Type II Class J or CC [A]
193-EC__B	100-C09	1,000	100,000	20	20
	100-C12	1,000	100,000	25	25
	100-C16	1,000	100,000	35	35
	100-C23	3,000	100,000	40	40
193-EC__D	100-C30	3,000	100,000	60	60
	100-C37	3,000	100,000	80	80
	100-C43	3,000	100,000	90	90
193-EC__E	100-C60	3,000	100,000	125	125
	100-C72	5,000	100,000	150	150
	100-C85	5,000	100,000	175	175



ATTENTION: Select the motor branch circuit protection that complies with the National Electrical Code and any other governing regional or local codes.

Typical Motor Connections Three-Phase Direct-on-Line (D.O.L)

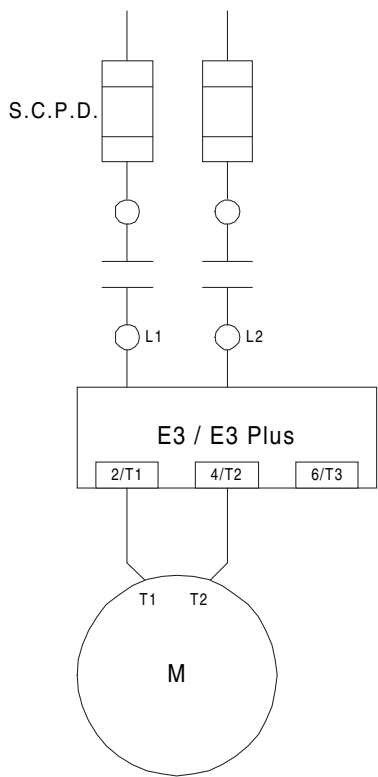
The following figure illustrates the EC4 Current Monitoring Relay typical motor connections in a three-phase D.O.L application.

Figure 10 - Three-Phase D.O.L Wiring Diagram

Single-Phase Full-Voltage

The following figure illustrates the EC4 Current Monitoring Relay Typical motor connections in a single-phase full voltage application.

Figure 11 - Single-Phase Full-Voltage Wiring Diagram



- IMPORTANT** Parameter 27, *Single/Three Ph*, should be set to single-phase.
- IMPORTANT** Traditional single-phase wiring (connecting T2 to L3) will result in a vector imbalance of current flowing through the EC4 Current Monitoring Relay. This will result in inaccurate ground fault reporting and protection.

External Line Current
Transformer Application

EC4 Current Monitoring Relays are designed for use with separately mounted, customer-supplied line current transformers (CTs) as required in higher-current applications. The FLA setting range is 9...5000 A for these units, with a legal setting range per current transformer. Parameter 78, *CT Ratio*, is provided for setting the current transformer ratio to be installed.

Current Transformer Specifications

The 193-EC_ZZ current monitoring relays are intended for use with CTs with a secondary current rating of 5 A. The installer shall provide one CT for each motor phase and shall connect the CT's secondary leads to the appropriate EC4 Current Monitoring Relay power terminals as shown in . The CTs shall have an appropriate ratio rating as detailed in Table 3.1. Additionally, the CT shall be selected to be capable of providing the required VA to the secondary load, which includes the EC4 Current Monitoring Relay burden of 0.1 VA at the rated

secondary current and the wiring burden. Finally, the CT shall be rated for *protective relaying* to accommodate the high inrush currents associated with motor startup and shall have an accuracy of $\leq \pm 2\%$ over its normal operating range. Typical CT ratings include:

ANSI (USA)	Class C5 B0.1
CSA (Canada)	Class 10L5
IEC (Europe)	5 VA Class 5P10

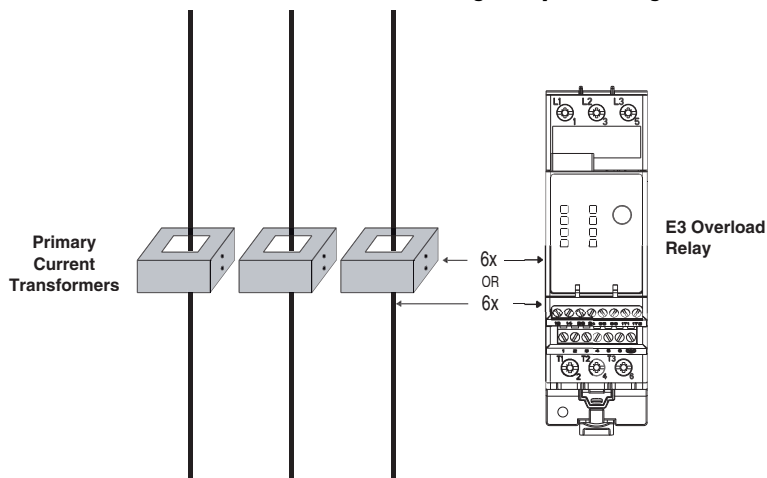


ATTENTION: The improper selection of a current transformer can result in the EC4 Current Monitoring Relay reporting inaccurate motor operational data, and possible motor damage. The selected current transformer must be rated for protective relaying applications.

Installation Instructions

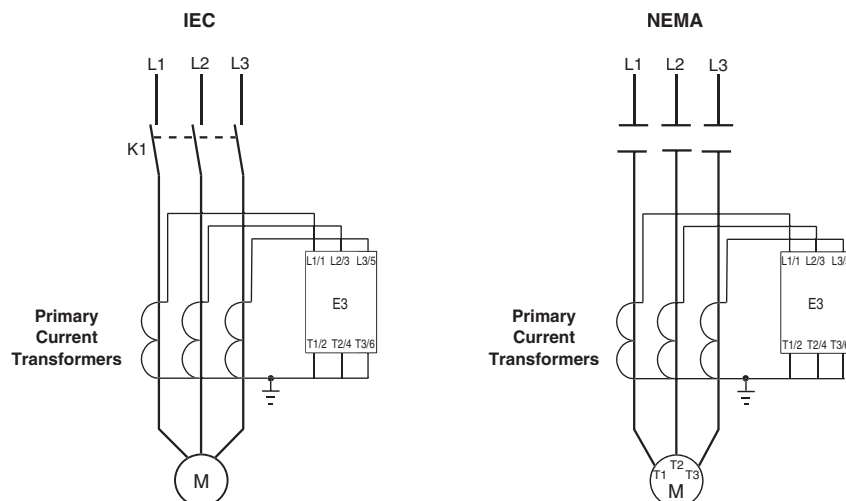
Cat. No. 193-EC_ZZ current monitoring relays are designed to be installed in cat. no. 193-ECPM2 panel mount adapters and connected to separately mounted current transformers. For panel mount adapter assembly, refer to the instructions included with the panel mount adapter. The EC4 Current Monitoring Relay must be mounted a distance equal to or greater than six times the cable diameter (including insulation) from the nearest current-carrying conductor or current transformer. For applications employing multiple conductors per phase, the diameter of each cable should be added and multiplied by six to determine the proper placement distance for the EC4 Current Monitoring Relay.

Figure 12 - Cat. No. 193-EC_ZZ Current Monitoring Relay Mounting Placement



ATTENTION: Placement of the EC4 Current Monitoring Relay closer than the recommended distance of six times the cable diameter may compromise its current reporting and protection capabilities.

Figure 13 - External CT Connection Diagrams



External Ground Fault Sensor Application

EC4 Current Monitoring Relays are intended to provide ground fault protection when used with the Cat. No. 193-CBCT_ external ground fault (core balance) sensor. The ground fault sensor mounts separately from the EC4 current monitoring relay and must be placed within three meters of it. The customer-supplied cable for wiring the ground fault sensor to the EC4 should meet the specifications outlined in Table 5.

Power Cable Installation Instructions

1. All power cables (including the neutral when used) must pass through the sensor window. The equipment ground conductor (the conductor used to carry the non-current-carrying metal parts of equipment, as defined by Article 100 of the NEC) must **not** pass through the sensor window.
2. The power cables through the sensor window should be straight, tightly bundled, centered in the window, and perpendicular to the sensor for a length equal to or greater than six times the cable diameter (including insulation) from the sensor.
3. All other conductors with available fault currents in excess of 1 000 A should be placed a distance equal to or greater than six times the cable diameter (including insulation) from the sensor.
4. The power cables of the branch circuit to be protected by the EC4 Current Monitoring Relay must not be grounded on the load side of the ground fault sensor.
5. If the power cables are enclosed in a conducting jacket, the jacket must be grounded on the line side of the sensor. The jacket must not pass through the sensor window, but must be cut at the window and joined with a conductor that passes outside the sensor window.

6. The power system may be solidly grounded or grounded through an impedance at its source as long as the impedance allows a magnitude of current to flow that is within the 20 mA...5 A operational range of the EC4 Current Monitoring Relay.

Figure 14 - Ground Fault Sensor Mounting Placement

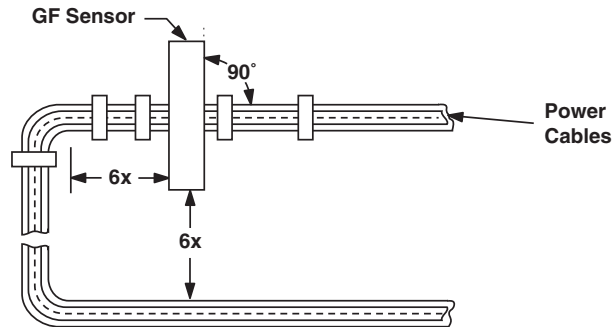
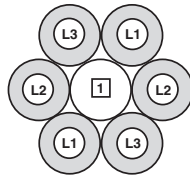
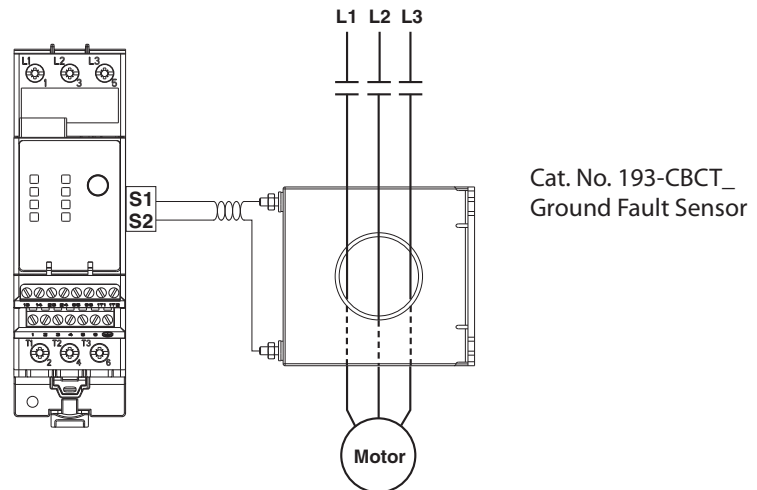


Figure 15 - Power Cable Configuration — Two Cables per Phase



- 1 The spacer is a short (approximately 10 times the cable diameter in length) piece of cable with no connections to any terminal.

Figure 16 - Ground Fault Sensor Wiring to the EC4 Current Monitoring Relay



IMPORTANT The shield of the twisted pair cable must be connected to earth ground at the sensor, with no connection made at the EC4 Current Monitoring Relay.

Maximum length of the shielded cable is 100 ft. All control terminals are for copper wire only in sizes #12...24 AWG. Ring lug termination is required for the ground sensor terminals of Cat. Nos. 193-CBCT2 and larger. Sensor fastener torque: 26...30 lb-in. Cat. No. 193-CBCT1 wires should be twisted before termination by applying one twist per inch.

Figure 17 - Control Wire Installation

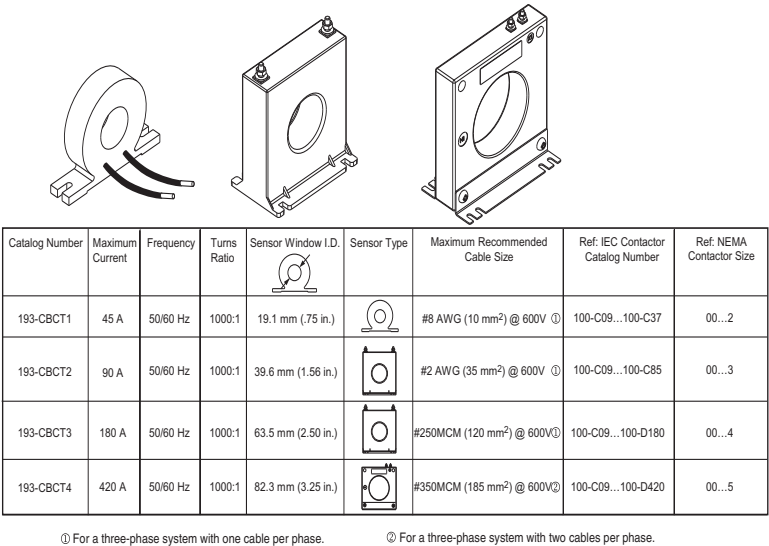
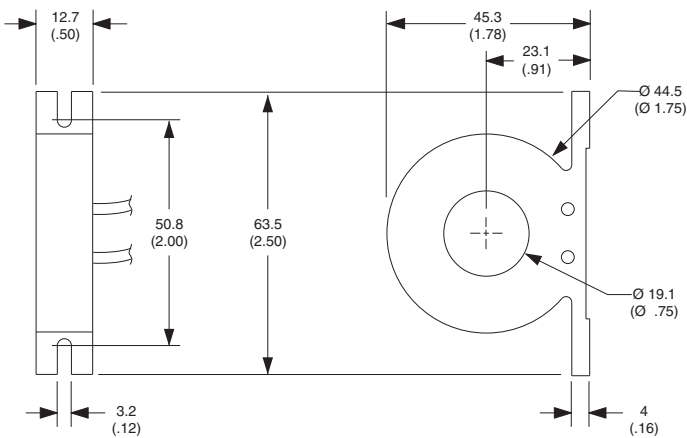
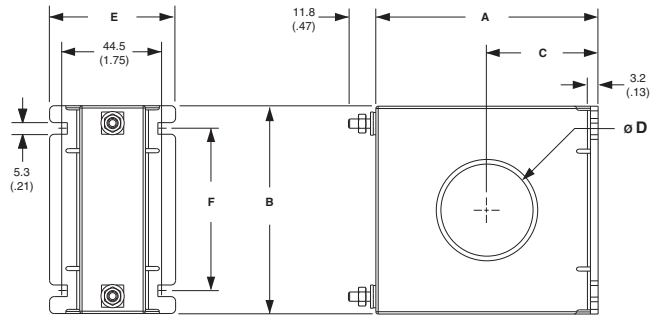


Figure 18 - Cat. No. 193-CBCT1 Approximate Dimensions [mm (in.)]



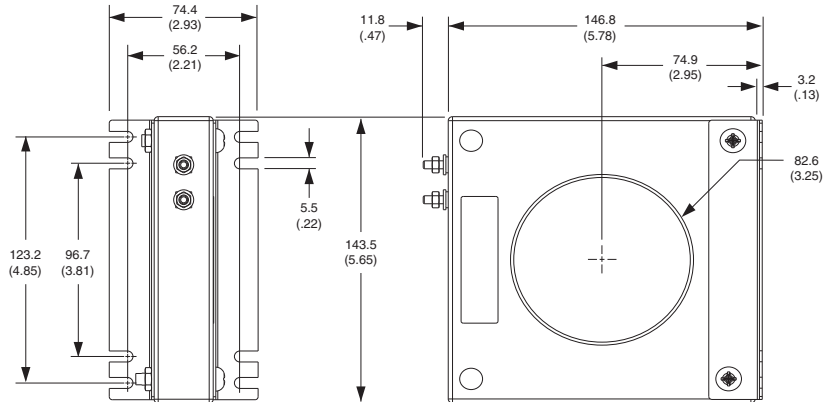
Cat. No. 193-CBCT1

Figure 19 - Cat. No. 193-CBCT2, -CBCT3 Approximate Dimensions [mm (in.)]



Cat. No.	Dimensions					
	A	B	C	ø D	E	F
193-CBCT2	96 (3.78)	89.6 (3.53)	48.3 (1.90)	39.6 (1.56)	54.6 (2.15)	69.9 (2.75)
193-CBCT3	122.4 (4.82)	115.9 (4.56)	59.7 (2.35)	63.5 (2.50)	54.1 (2.13)	96 (3.78)

Figure 20 - Cat. No. 193-CBCT4 Approximate Dimensions [mm (in.)]



Cat. No. 193-CBCT4

Typical Control Circuit Wiring Diagrams



ATTENTION: The ratings of the EC4 Current Monitoring Relay's output and trip relay must not be exceeded. If the coil current or voltage of the contactor exceeds the relay's ratings, an interposing relay must be used.



ATTENTION: When the power is applied to the EC4 Current Monitoring Relay (DeviceNet terminals V+ and V-), the N.O. trip relay contact across terminals 95 and 96 will close after approximately 2.35 seconds if no trip condition exists.



ATTENTION: Additional control circuit protection may be required. Refer to the applicable electrical codes.



ATTENTION: Do not apply external voltage to 1T1, 1T2, or the input terminals IN 1...4. This may cause equipment damage.

Full-Voltage Non-Reversing (with Network Control)

Figure 21 - Full-Voltage Non-Reversing Starter Wiring Diagram (NEMA Nomenclature)

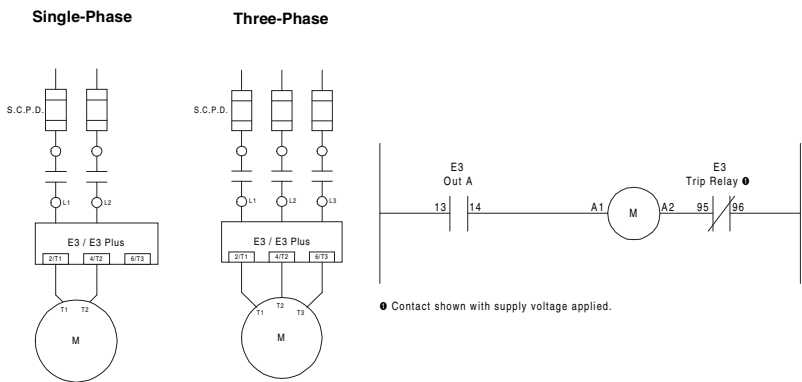
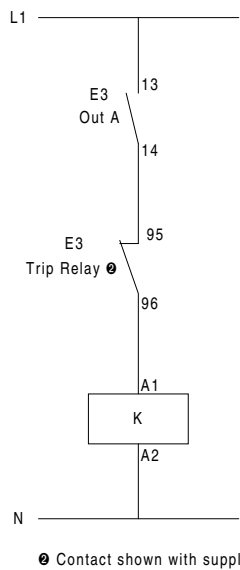


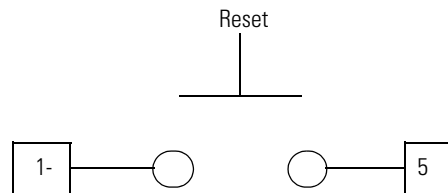
Figure 22 - Full-Voltage Non-Reversing Starter Wiring Diagram (CENELEC Nomenclature)



External/Remote Reset (FRN 3.001 and later)

To reset a trip from an external/remote location, configure one of the EC4 Current Monitoring Relay's inputs for trip reset operation using one of parameters 83...86. Wire the input as shown in Figure 23 .

Figure 23 - External/Remote Reset Wiring



IMPORTANT	Reset operation is edge sensitive and trip free; that is, holding the push button down (maintaining the reset contact in a closed position) will not prevent the EC4 Current Monitoring Relay from tripping.
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Protective Trip and Warning Functions

Introduction

The purpose of this chapter is to provide detailed information regarding the protective trip and warning functions of the EC4 Current Monitoring Relay. In this chapter, you will find considerable mention given to programming parameters as they relate to these functions. For complete descriptions of the programming parameters, refer to **Chapter 5 — Programmable Parameters**.

Trip Enable

Parameter 24, *Trip Enable*, allows the installer to enable or disable the desired protective functions separately. The overcurrent, undercurrent, and communication fault trip functions are enabled from the factory.

IMPORTANT The EC4 Current Monitoring Relay requires undercurrent (UC)/overcurrent (OC) to be enabled at all times. The EC4 Current Monitoring Relay requires either UC/OC to be enabled at all times.



ATTENTION: The Trip Enable settings should not be altered during machine operation, as unexpected behavior of the outputs could occur. This may result in an unintended actuation of controlled industrial equipment, with the potential for machine damage or serious injury to personnel.

Warning Enable

Parameter 25, *Warning Enable*, allows the installer to enable or disable the desired warning functions separately. All warning functions are disabled from the factory.

Overcurrent Protection

The EC4 Current Monitoring Relay provides UC/OC protection through true RMS current measurement of the individual phase currents of the connected loads. For *Undercurrent & Overcurrent Trip and Warning Level* parameters, a warning or trip will occur when the programmed conditions are satisfied.

Table 11 - Overcurrent Setting Ranges

Current Range [A]	Min. [A]	Max. [A]	Default [A]
0.4...2	0.4	2.5	0.4
1...5	1	6.25	1
3...15	3	18.75	3
5...25	5	31.25	5
9...45	9	56.25	9
18...90	18	112.5	18
9...5000	9	6250	9

Overcurrent Warning

The EC4 Current Monitoring Relay will issue a warning with an overcurrent condition if:

- The current in any of the phases exceeds the current specified for the corresponding OC Warn Level parameter (Parameter 120 for L1, parameter 123 for L2, & parameter 126 for L3)
- No warning condition already exists

If an overcurrent warning parameter is satisfied, the following will occur:

- The TRIP/WARN LED will flash a yellow blinking pattern depending on which phase encountered the overcurrent warning condition
 - 5 blinks for L1 overcurrent
 - 6 blinks for L2 overcurrent
 - 7 blinks for L3 overcurrent
- Parameter 15, Warning Status, will change
 - Bit 4 will go to "1" for L1 overcurrent
 - Bit 5 will go to "1" for L2 overcurrent
 - Bit 6 will go to "1" for L3 overcurrent
- Bit _ in Parameter 21, Device Status, will go to "1"

Overcurrent Trip

The EC4 Current Monitoring Relay will trip with an overcurrent indication if:

- The current in any of the phases exceeds the current specified for the corresponding OC Trip Level parameter (Parameter 118 for L1, parameter 121 for L2, & parameter 124 for L3)
- No trip currently exists

If the EC4 Current Monitoring Relay trips on an overcurrent condition, the following will occur:

- The TRIP/WARN LED will flash a red blinking pattern depending on which phase encountered the overcurrent
 - 5 red blinks for L1 overcurrent
 - 6 red blinks for L2 overcurrent
 - 7 red blinks for L3 overcurrent
- Parameter 14, Trip Status, will change
 - Bit 4 will go to "1" for L1 overcurrent
 - Bit 5 will go to "1" for L2 overcurrent
 - Bit 6 will go to "1" for L3 overcurrent
- Bit 0 in Parameter 21, Device Status, will go to "1"
- The outputs will be placed in their Protection Fault state (if so programmed)

Ground Fault Protection

In isolated or high impedance-grounded systems, core-balanced current sensors are typically used to detect low level ground faults caused by insulation breakdowns or entry of foreign objects. Detection of such ground faults can be used to interrupt the system to prevent further damage, or to alert the appropriate personnel to perform timely maintenance.

The EC4 Current Monitoring Relay provides core-balanced ground fault detection capability, with the option of enabling Ground Fault Trip, Ground Fault Warning, or both. The ground fault detection method and range depends upon the catalog number of the relay ordered. The EC4 can measure from 20 mA...5 A of ground fault current ❶❷.

❶ Must use one of the followign ground fault sensors:

Cat. No. 193-CBCT1 — 20 mm diameer window

Cat. No. 193-CBCT2 — 40 mm diameer window

Cat. No. 193-CBCT3 — 65 mm diameer window

Cat. No. 193-CBCT4 — 85 mm diameer window

❷ 20...100 mA for resistive loads only. For motor load information, please consult your local Allen-Bradley distributor.



ATTENTION: The EC4 Current Monitoring Relay is **not** a ground fault circuit interruptor for personnel protection as defined in Article 100 of the NEC.



ATTENTION: The EC4 Current Monitoring Relay is **not** intended to signal a disconnecting means to open the faulted current. A disconnecting device must be capable of interrupting the maximum available fault current of the system on which it is used.

Ground Fault Setting Range

EC4 Current Monitoring Relays using the external ground fault sensor (Cat. no. 193-CBCT_) have four sensing ranges, which are selectable via the *GF Sensing Range* parameter.

Parameter 106, *GF Sensing Range* (Series C and later)

- 20...100 mA (For resistive loads only. For motor load information, please consult your local Rockwell Automation sales office or Allen-Bradley distributor.)
- 100...500 mA
- 200 mA ...1.0 A
- 1.0...5.0 A

Ground Fault Trip

The EC4 Current Monitoring Relay will trip with a ground fault indication if:

- No trip currently exists
- Ground fault protection is enabled
- *GF Inhibit Time* has expired
- *GF Current* is equal to or greater than the *GF Trip Level* for a time period greater than the *GF Trip Delay*

If the EC4 Current Monitoring Relay trips on a ground fault, the following will occur:

- The TRIP/WARN LED will flash a red 4-blink pattern
- Bit 3 in Parameter 14, *Trip Status*, will go to “1”
- Bit 0 of Parameter 21, *Device Status*, will go to “1”
- The Trip Relay contact will open
- The outputs will be placed in their Protection Fault state (if so programmed)

IMPORTANT The Protection Fault State of OUT A and OUT B is defined by Parameter 65 (*OUTA Pr FltState*), Parameter 66 (*OUTA Pr FltValue*), Parameter 71 (*OUTB Pr FltState*), and Parameter 72 (*OUTB Pr FltValue*).

Parameter 35, *GF Inhibit Time*, allows the installer to inhibit a ground fault trip from occurring during the motor starting sequence and is adjustable from 0...250 seconds.

Parameter 36, *GF Trip Delay*, allows the installer to define the time period a ground fault condition must be present before a trip occurs. It is adjustable from 0.0...25.0 seconds.

Parameter 37, *GF Trip Level*, allows the installer to define the ground fault current at which the EC4 Current Monitoring Relay will trip. It is adjustable from 20.0 mA...5.0 A

IMPORTANT	The ground fault inhibit timer starts after the maximum phase of load current transitions from 0 A to 30% of the device's minimum <i>FLA Setting</i> or the <i>GF Current</i> is greater than or equal to 50% of the device's minimum <i>GF Current</i> setting. The EC4 Current Monitoring Relay does not begin monitoring for a ground fault condition until the <i>GF Inhibit Time</i> expires.
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Ground Fault Trip Inhibit

Ground faults can quickly rise from low-level arcing levels to short circuit magnitudes. A motor starting contactor may not have the necessary rating to interrupt a high magnitude ground fault. In these circumstances it is desirable for an upstream circuit breaker with the proper rating to interrupt the ground fault. When enabled, Parameter 89, *GF Trip Inhibit*, inhibits a ground fault trip from occurring when the ground fault current exceeds the maximum range of the core balance sensor (approximately 10 A). Note: This feature is only available in series B and later devices.

Ground Fault Warning

The EC4 Current Monitoring Relay will indicate a Ground Fault warning if:

- No warning currently exists
- Ground fault warning is enabled
- *GF Inhibit Time* has expired
- *GF Current* is equal to or greater than the *GF Warn Level* (Series C and later devices; for a time period greater than the *GF Warn Delay*)

When the Ground Fault warning conditions are satisfied, the following will occur:

- The TRIP/WARN LED will flash an amber 4-blink pattern
- Bit 3 in Parameter 15, *Warning Status*, will go to "1"
- Bit 1 of Parameter 21, *Device Status*, will go to "1"

Parameter 38, *GF Warn Level*, allows the installer to define the ground fault current at which the EC4 Current Monitoring Relay will indicate a warning and is adjustable from 20 mA...5.0 A.

Parameter 105, *GF Warn Delay* (Series C and later), allows the installer to define the time period (adjustable from 0.0...25.0 s) for which a ground fault condition must be present before a warning occurs.

IMPORTANT In EC4 Current monitoring relays, the Ground Fault warning function does not include a time delay feature. Once the *GF Inhibit Time* has expired, the Ground Fault warning indication is instantaneous.

Undercurrent Protection

Motor current less than a specific level may indicate a mechanical malfunction in the installation, such as a torn conveyor belt, damaged fan blade, broken shaft, or worn tool. Such conditions may not harm the motor, but they can lead to loss of production. Rapid undercurrent fault detection helps to minimize damage and loss of production.

Table 12 - Undercurrent Setting Ranges

Current Range [A]	Min. [A]	Max. [A]	Default [A]
0.4...2	0.2	2	2
1...5	0.5	5	5
3...15	1.5	15	15
5...25	2.5	25	25
9...45	4.5	45	45
18...90	9	90	90
9...5000	5	5000	45

Undercurrent Warning

The EC4 Current Monitoring Relay will issue a warning with an undercurrent condition if:

- The current in an of the phases is lower than the current specified for the corresponding *UC Trip Level* parameter (Parameter 110 for L1, parameter 113 for L2, & parameter 116 for L3)
- No warning condition already exists

If an undercurrent warning parameter is satisfied, the following will occur:

- The TRIP/WARN LED will flash a yellow blinking pattern depending on which phase encountered the undercurrent warning condition
 - 2 blinks for L1 undercurrent
 - 3 blinks for L2 undercurrent
 - 4 blinks for L3 undercurrent
- Parameter 15, *Warning Status*, will change
 - Bit 1 will go to "1" for L1 undercurrent
 - Bit 2 will go to "1" for L2 undercurrent
 - Bit 3 will go to "1" for L3 undercurrent
- Bit 1 in Parameter 21, Device Status, will go to "1"

Parameter 48, *UL Warn Level*, allows the installer to define the current at which the EC4 Current Monitoring Relay will indicate a warning.

IMPORTANT	The Underload Warning function does not include a time delay feature. Once the <i>UL Inhibit Time</i> has expired, the Underload warning indication is instantaneous.
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IMPORTANT	For any given application, the practical limit of <i>UL Warn Level</i> (Parameter 48) will be dependent upon the FLA setting and the lower limit of the EC4 Current Monitoring Relay's current measurement capability. See Table 20 - on page 83
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Undercurrent Trip

The EC4 Current Monitoring Relay will trip with an undercurrent indication if:

- The current in any of the phases is lower than the current specified for the corresponding *UC Trip Level* parameter (Parameter 108 for L1, parameter 111 for L2, & parameter 114 for L3)
- No trip currently exists

If the EC4 Current Monitoring Relay trips on an undercurrent condition, the following will occur:

- The TRIP/WARN LED will flash a red blinking pattern depending on which phase encountered the undercurrent condition
 - 2 blinks for L1 undercurrent
 - 3 blinks for L2 undercurrent
 - 4 blinks for L3 undercurrent
- Parameter 14, *Trip Status*, will change
 - Bit 1 will go to "1" for L1 undercurrent
 - Bit 2 will go to "1" for L2 undercurrent
 - Bit 3 will go to "1" for L3 undercurrent
- Bit 0 in Parameter 21, Device Status, will go to "1"
- The outputs will be placed in their Protection Fault state (if so programmed)

IMPORTANT	The Protection Fault State of OUT A and OUT B is defined by Parameter 65 (<i>OUTA Pr FltState</i>), Parameter 66 (<i>OUTA Pr FltValue</i>), Parameter 71 (<i>OUTB Pr FltState</i>), and Parameter 72 (<i>OUTB Pr Flt Value</i>).
------------------	--

Parameter 45, *UL Inhibit Time*, allows the installer to inhibit an underload trip from occurring during the motor starting sequence and is adjustable from 0...250 seconds.

Parameter 46, *UL Trip Delay*, allows the installer to define the time period that an underload condition must be present before a trip occurs. It is adjustable from 0.1...25.0 seconds.

Parameter 47, *UL Trip Level*, allows the installer to define the current at which the EC4 Current Monitoring Relay will trip on an Underload.

IMPORTANT The underload inhibit timer starts after the maximum phase of load current transitions from 0 A to 30% of the device's minimum *FLA Setting*. The EC4 Current Monitoring Relay does not begin monitoring for an underload condition until the *UL Inhibit Time* expires.

IMPORTANT For any given application, the practical limit of *UL Trip Level* (Parameter 47) will be dependent on the FLA setting and the lower limit of the EC4 Current Monitoring Relay's current measurement capability. See Table 20 - on page 83.

Communication Fault Protection

A disruption of the communication link between the EC4 Current Monitoring Relay and a DeviceNet network can result in the loss of application control and/or critical process diagnostic data. Rapid communication fault detection helps minimize potential damage due to uncontrolled or unmonitored applications.

Comm Fault Trip

The EC4 Current Monitoring Relay will trip with a Comm Fault indication if:

- No trip currently exists
- Comm Fault protection is enabled
- The EC4 Current Monitoring Relay experiences a loss of communication

If the relay trips on a Comm Fault, the following will occur:

- The Network Status LED will blink red or become solid red
- The TRIP/WARN LED will flash a red 10-blink pattern
- Bit 9 in Parameter 14, *Trip Status*, will go to "1"
- Bit 0 in Parameter 21, *Device Status*, will go to "1"
- The Trip Relay contacts will open
- The outputs will be placed in their Protection Fault State (if so programmed)

IMPORTANT The Protection Fault State of OUT A and OUT B is defined by Parameter 65 (*OUTA Pr FltState*), Parameter 66 (*OUTA Pr FltValue*), Parameter 71 (*OUTB Pr FltState*), and Parameter 72 (*OUTB Pr FltValue*).

IMPORTANT The Comm Fault State of OUT A and OUT B is defined by Parameter 67 (*OUTA Dn FltState*), Parameter 68 (*OUTA Dn FltValue*), Parameter 73 (*OUTB Dn FltState*), and Parameter 74 (*OUTB Dn FltValue*).

Comm Fault Warning

The EC4 Current Monitoring Relay will indicate a Comm Fault warning if:

- No warning currently exists
- Comm Fault Warning is enabled
- The relay experiences a loss of communication

When the Comm Fault warning conditions are satisfied, the following will occur:

- The Network Status LED will blink red or become solid red
- The TRIP/WARN LED will flash an amber 10-blink pattern
- Bit 9 in Parameter 15, *Warning Status*, will go to “1”
- Bit 1 of Parameter 21, *Device Status*, will go to “1”

If a communication fault occurs and either Comm Fault Trip is not enabled or the Pr FltState parameters are set to “Ignore”, the following will occur:

- The Network Status LED will blink red or become solid red
- The outputs will be placed in their Comm Fault

Communication Idle Protection

When a programmable controller is placed into the program mode, the execution of its ladder program is suspended, and any connected networks go to an idle state. If inadvertent, this can result in the loss of application control and/or critical process diagnostic data. Rapid communication idle detection helps minimize the potential damage due to uncontrolled or unmonitored applications.

Comm Idle Trip

The EC4 Current Monitoring Relay will trip with a Comm Idle indication if:

- No trip currently exists
- Comm Idle protection is enabled
- The network controller that the EC4 Current Monitoring Relay is communicating to is placed to program mode

If the relay trips on a Comm Idle, the following will occur:

- The TRIP/WARN LED will flash a red 11-blink pattern
- Bit 10 in Parameter 14, *Trip Status*, will go to “1”

- Bit 0 of Parameter 21, *Device Status*, will go to “1”
- The Trip Relay contact will open
- The outputs will be placed in their Protection Fault State (if so programmed)

IMPORTANT The Protection Fault state of OUT A and OUT B is defined by Parameter 65 (*OUTA Pr FltState*), Parameter 66 (*OUTA Pr FltValue*), Parameter 71 (*OUTB Pr FltState*), and Parameter 72 (*OUTB Pr FltValue*).

IMPORTANT The Comm Idle State of OUT A and OUT B is defined by Parameter 69 (*OUTA Dn IdlState*), Parameter 70 (*OUTA Dn IdlValue*), Parameter 75 (*OUTB Dn IdlState*), and Parameter 76 (*OUTB Dn IdlValue*).

Comm Idle Warning

The EC4 Current Monitoring Relay will indicate a Comm Idle warning if:

- No warning currently exists
- Comm Idle Warning is enabled
- The network controller that is communicating to the EC4 Current Monitoring Relay is placed in idle mode

When the Comm Idle warning conditions are satisfied, the following will occur:

- The TRIP/WARN LED will flash an amber 11-blink pattern
- Bit 10 in Parameter 15, *Warning Status*, will go to “1”
- Bit 1 in Parameter 21, *Device Status*, will go to “1”

If a communication idle occurs and either Comm Idle Trip is not enabled or the *Pr FltState* parameters are set to “Ignore”, the following will occur:

- The outputs will be placed in their Comm Idle State

Remote Trip

The Remote Trip function provided in series B and later devices allows the capability of tripping the EC4 Current Monitoring Relay from a remote source (for example, a vibration switch). Proper set-up requires that Remote Trip is enabled in Parameter 24, *Trip Enable*, and that an input assignment (Parameters 83 – 86) is configured for Remote Trip.

When the remote trip condition sensor contact closes:

- The TRIP/WARN LED will flash a red 15-blink pattern
- Bit 14 in Parameter 14, *Trip Status*, will go to “1”.
- The Trip relay contact will open.

- The outputs will be placed in their Protection Fault State (if so programmed).

IMPORTANT The Protection Fault state of OUT A and OUT B is defined by Parameter 65 (*OUTA Pr FltState*), Parameter 66 (*OUTA Pr FltValue*), Parameter 71 (*OUTB Pr FltState*) and Parameter 72 (*OUTB Pr FltValue*).

Preventive Maintenance Diagnostics

The purpose of this section is to provide detailed information regarding the Preventive Maintenance Diagnostic functions of the EC4 Current Monitoring Relays. In this section programming and monitoring parameters as they relate to these functions will be discussed. For complete descriptions of the programming parameters, refer to Programmable Parameters on page 5-58.

Monitoring

Parameter 95, *Elapsed Time*, logs the hours of motor operation — the time period that the EC4 Current Monitoring Relay is sensing motor current present (must be greater than 30% of the minimum Full Load Current (FLA) setting).

Parameter 96, *Starts Counter*, logs the number of starts, defined as the number of times motor current transitions from zero to a reported non-zero value (motor current must be greater than 30% of the minimum Full Load Current (FLA) setting).

IMPORTANT The EC4 Current Monitoring Relay will report 0 A or 0% FLA if the current is below 30% of the minimum FLA setting.

Preventive Maintenance Flags

The EC4 Current Monitoring Relay offers preventive maintenance flags in the *Warning Status* parameter based on the number of start cycles or the number of operating hours (motor current must be greater than 30% of the minimum Full Load Current (FLA) setting). These can be used to send the user a warning message that the number of starts or number of operating hours has been reached and that it is time to perform preventive maintenance. The preventive maintenance warning function can be set by: *PM - # Starts* and/or *PM - Oper. Hours*.

IMPORTANT The EC4 Current Monitoring Relay will report 0 A or 0% FLA if the current is below 30% of the minimum FLA setting.

The EC4 Current Monitoring Relay will give a *PM - # Starts* warning indication when:

- *PM - # Starts* warning is enabled

- *Starts Counter* parameter is equal to or greater than the value set in the *PM - # Starts* parameter

Upon a *PM - # Starts* warning, the following will occur:

- The TRIP/WARN LED will flash an amber 14-blink pattern
- Bit 13 in Parameter 15, *Warning Status*, will go to “1”
- Bit 1 in Parameter 21, *Device Status*, will go to “1”

Parameter 101, *PM - # Starts*, allows the installer to set a number of starts. It is adjustable from 0...65,535.

The EC4 Current Monitoring Relay will give a *PM – Oper. Hours* warning indication when:

- *PM – Oper. Hours* warning is enabled
- *Elapsed Time* parameter is equal to or greater than the value set in the *PM – Oper. Hours* parameter

Upon a *PM – Oper. Hours* warning, the following will occur:

- The TRIP/WARN LED will flash an amber 15-blink pattern
- Bit 14 in Parameter 15, *Warning Status*, will go to “1”
- Bit 1 in Parameter 21, *Device Status*, will go to “1”

Parameter 102, *PM – Oper. Hours*, allows the installer to set a number of hours of operation. It is adjustable from 0...65,565 hours.

Queue Clearing

The EC4 Current Monitoring Relay provides the capability to clear the *Trip Logs*, *Warning Logs*, *Starts Counter*, and the *Elapsed Time* using the *Clear Queue* parameter. If using the Preventative Maintenance Flags, the user will want to reset the *Starts Count* and *Elapsed Time* after preventative maintenance has been performed.

Parameter 104, *Clear Queue*, allows the user to clear the *Trip Logs* (parameters 16...20), *Warning Logs* (parameters 90...94), *Starts Counter* (parameter 96), and the *Elapsed Time* (parameter 95). The *Clear Queue* parameter will clear/reset all of these parameters at the same time.

DeviceNet Node Commissioning

-
- IMPORTANT** The following recommendations are intended to ensure a trouble-free startup and operation:
1. Use the node commissioning tool in RSNetWorx or the E3 programming and control terminal when modifying the E3's node address. Do not use the "General" tab found in the product window in RSNetWorx. The Node Commissioning tool ensures that the device goes through a hard reset and requires the user to upload the most current parameter information from the device prior to making configuration changes.
 2. Ensure that you have the most current configuration information prior to saving an RSNetWorx configuration file.
 3. If you intend to employ the ADR function of the DeviceNet scanner, ensure that the device configuration is as you intend it BEFORE saving to memory.
 4. Be aware that the "Restore Device Defaults" button in RSNetWorx will reset the EC4 Current Monitoring Relay's node address setting to 63. For Series B and later devices, the hardware node address switches take precedence over the software node address setting.
-

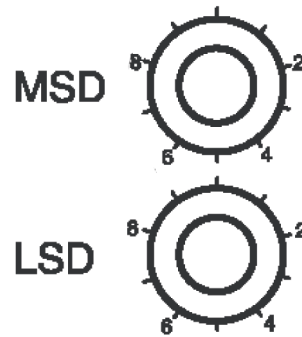
Introduction

EC4 Current Monitoring Relays are shipped with a default software node address (MAC ID) setting of 63 and the data rate set to Autobaud. Each device on a DeviceNet network must have a unique node address which can be set to a value from 0 to 63. Keep in mind that most DeviceNet systems use address 0 for the master device (Scanner) and node address 63 should be left vacant for introduction of new slave devices. The node address and data rate for the EC4 Current Monitoring Relay can be changed using software or by setting the hardware switches that reside on the front of each unit. While both methods yield the same result, it is a good practice to choose one method and deploy it throughout the system.

Setting the Hardware Switches (Series B and later)

Use the following steps to commission the card.

1. Set the node address switches.

Figure 24 - Node Address Switches**Table 13 - Node Address Setting**

Switch Settings	Description
0...63	The node address setting is determined by the switch values when set in this range.
64...99	For switch settings in this range, the node address setting is determined by the software setting using the RSNetWorx for DeviceNet configuration tool.
99	Factory default setting.

IMPORTANT Resetting an EC4 Current Monitoring Relay to factory default values will also effect the node address setting for node address switch settings of 64 to 99.

- For node address switch values in the range of 0 to 63, cycle power to the EC4 Current Monitoring Relay to initialize the new setting.

Using RSNetWorx for DeviceNet

Going Online

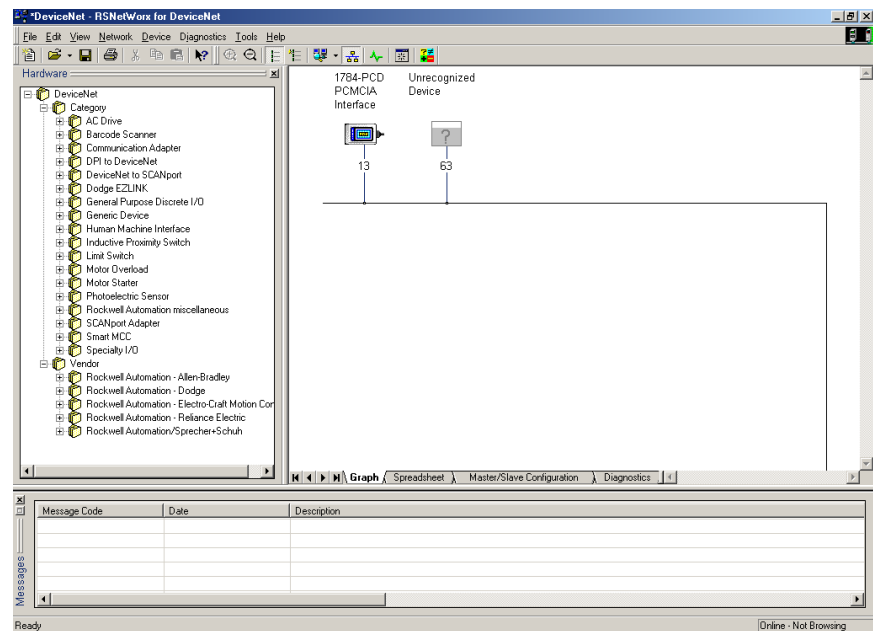
Follow these additional steps for node address switch settings in the range of 64...99. To begin the configuration of an EC4 Current Monitoring Relay using software, execute the RSNetWorx software and complete the following procedure. You must use RSNetWorx Revision 3.21 Service Pack 2 or later.

- After going on-line using RSNetWorx for DeviceNet, do the following:
 - Select the “Network” menu.
 - Select “Online”.
- Choose the appropriate DeviceNet PC interface. In this example, a 1784-PCD module is chosen. Other common DeviceNet interfaces are the 1770-KFD and 1784-PCIDS.

- TIP** DeviceNet drivers must be configured using RSLinx prior to being available to RSNetWorx.
3. Select “OK”.
 4. RSNetWorx notifies the user to upload or download devices before viewing configuration. Select “OK”.
 5. RSNetWorx now browses the network and displays all of the nodes it has detected on the network. For some versions of RSNetWorx software, the Series B and later EC4 Current Monitoring Relay EDS files may not be included, and the device will be identified as an “Unrecognized Device”.

If the screen appears like the example in Figure 25 -, continue with Building and Registering an EDS file.

Figure 25 - Network Online Screen



6. If RSNetWorx recognizes the device as an EC4 Current Monitoring Relay, skip ahead to the following section – Using the Node Commissioning Tool of RSNetWorx for DeviceNet.

TIP Node Commissioning can also be accomplished by using the DeviceNet Configuration Terminal, Cat. No. 193-DNCT.

Building and Registering an EDS File

The EDS file defines how RSNetWorx for DeviceNet will communicate to the EC4 Current Monitoring Relay. The EDS file can be created over the DeviceNet network or downloaded from the Internet.

TIP If you are using DeviceLogix functionality, you must download the EDS file from www.ab.com/networks.eds.

Do the following to build and register the EDS file.

1. Right-click on the “Unrecognized Device” icon. The Register Device menu appears.
2. Select “Yes”. The EDS Wizard will appear.
3. Select “Next”.
4. Select “Create an EDS File”.
5. Select “Next”.
6. Select “Upload EDS” (see note above).
7. Select “Next”. The following screen appears:

Figure 26 - EDS Wizard Screen

Rockwell Software's EDS Wizard

Device Description
Enter the device's identification information.

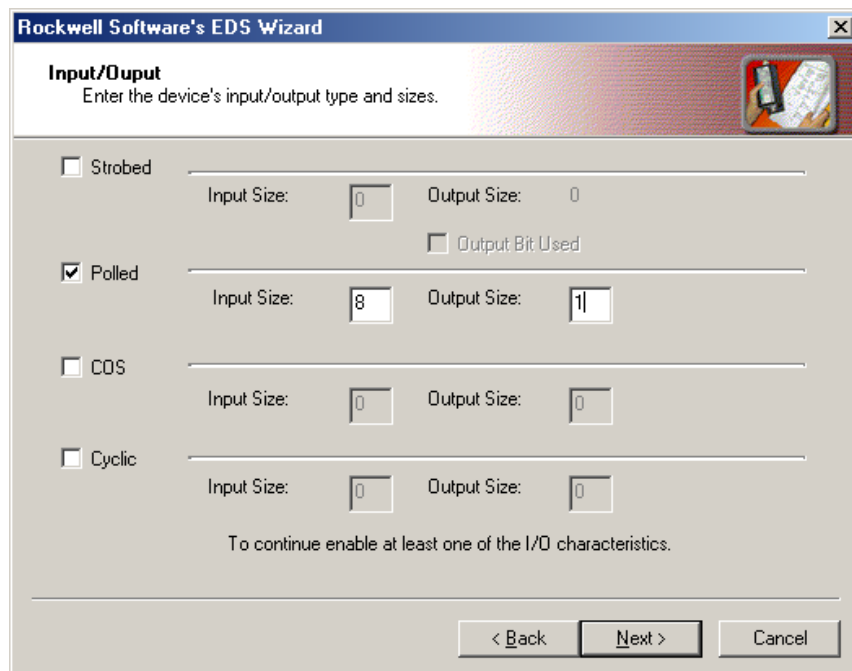
Device Identity		Vendor Name	
Vendor ID	1	Rockwell Automation - Allen-Bradley	
Product Type	3	Product Type String	
Product Code	32	Motor Overload	
Major Revision	32	Product Name	
Minor Revision	1	E3 Plus [9-5000A]	
		Catalog	

File Description Text
This is an EDS file created by Rockwell Software's EDS Installation Wizard.

< Back **Next >** Cancel

8. (Optional) Do the following.
 - a. Type a value in Catalog.
 - b. Type a description in File Description Text.
9. Select “Next”.

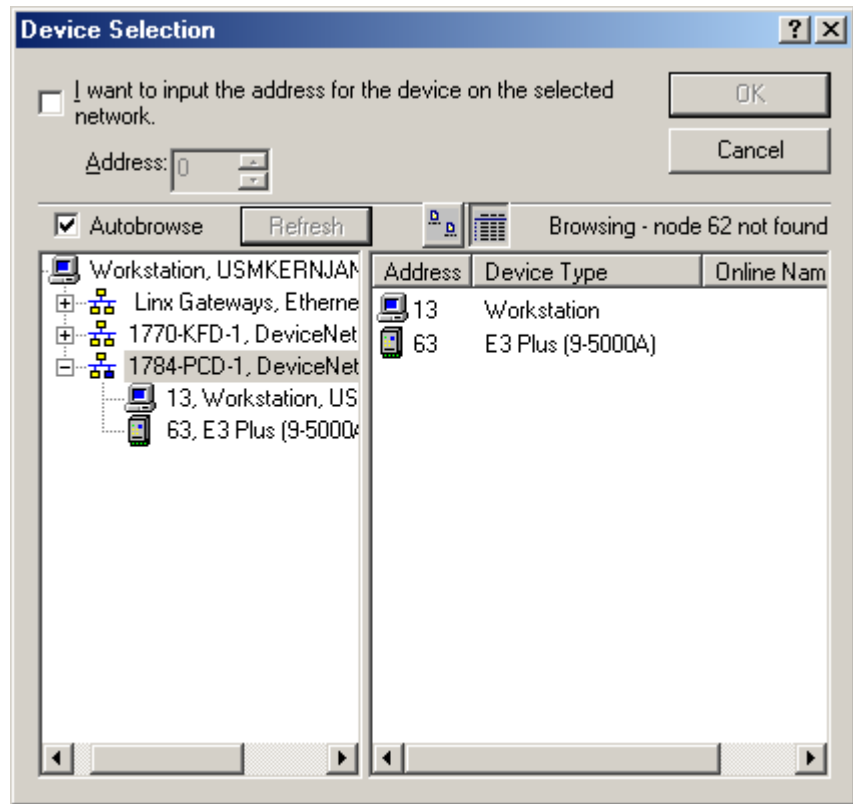
Figure 27 - Setting Default I/O Assembly Sizes



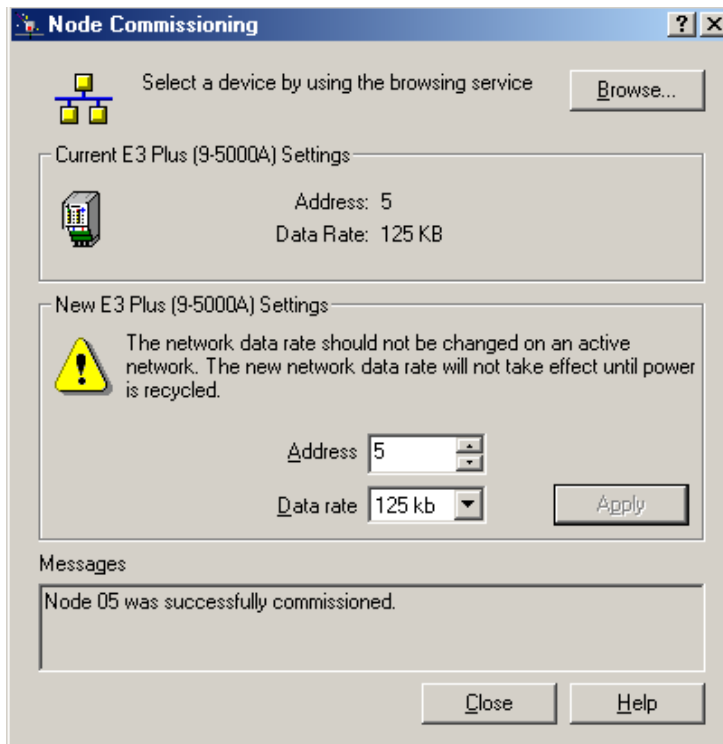
10. Next to the selected Polled check box, do the following:
 - a. Type 8 in Input Size.
 - b. Type 1 in Output Size.
11. Select “Next”. RSNetWorx uploads the EDS file from the EC4 Current Monitoring Relay.
12. To display the icon options for the node, select “Next”.
13. Select the EC4 Current Monitoring Relay icon by highlighting it and clicking “Change Icon”.
14. After selecting the desired icon, select “OK”.
15. Select “Next”.
16. When prompted to register this device, select “Next”.
17. Select “Finish”. After a short time, RSNetWorx updates the online screen by replacing “Unrecognized Device” with the name and icon given by the EDS file that you have just registered.

Using the Node Commissioning Tool of RSNetWorx for DeviceNet

1. From the Tools menu at the top of the screen, select “Node Commissioning”.
2. Select “Browse”.

Figure 28 - Node Commissioning Device Solution Window

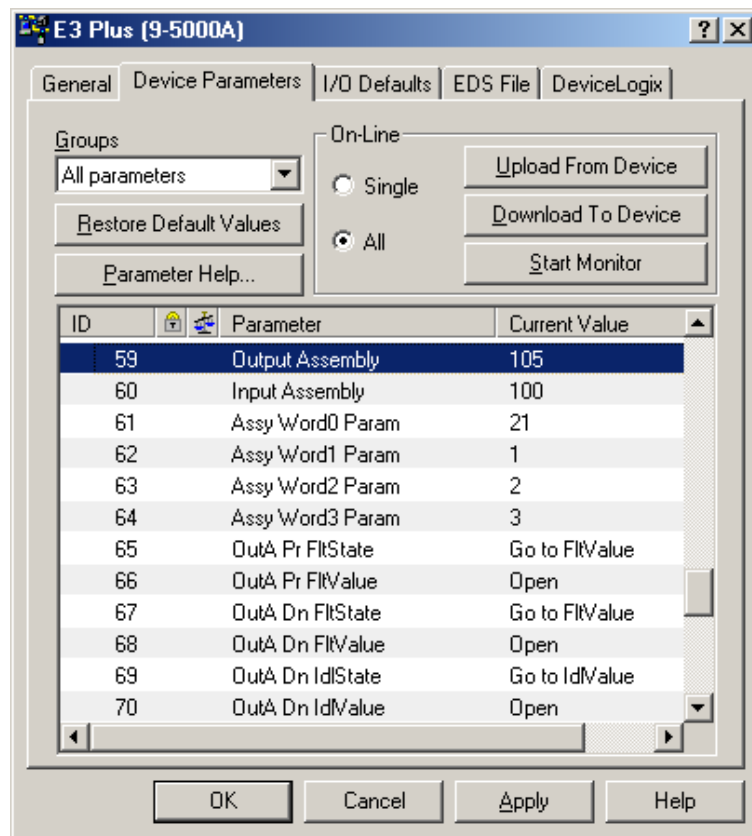
3. Select the EC4 Current Monitoring Relay located at node 63.
4. Select “OK”. The Node Commissioning screen shows Current Device Settings entries completed. It will also provide the current network baud rate in the New EC4 Current Monitoring Relay Settings area. Do not change the baud rate setting, unless you are sure it must be changed.
5. Type the node address that you want in the New Device Settings section. In this example, the new node address is 5.
6. To apply the new node address, select “Apply”.
7. When the new node address has been successfully applied, the Current Device Settings section of the window is updated (see the example below). If an error occurs, check to see if the device is properly powered up and connected to the network.

Figure 29 - Node Commissioning Confirmation Window

8. To exit the node commissioning tool, select “Close”.
9. To update RSNetWorx and verify that the node address is set correctly, select “Single Pass Browse” from the Network menu.

Produced and Consumed Assembly Configuration

The Input and Output Assembly format for the EC4 Current Monitoring Relay is identified by the value in parameter 59 (Output Assembly) and parameter 60 (Input Assembly). These values determine the amount and arrangement of the information communicated to the master scanner.

Figure 30 - I/O Assembly Settings

Selection of Input and Output Assemblies (also referred to as Produced and Consumed Assemblies) define the format of I/O message data that is exchanged between the EC4 Current Monitoring Relay and other devices on the network. The consumed information is generally used to command the state of the slave device's outputs, and produced information typically contains the state of the inputs and the current fault status of the slave device.

The default Consumed and Produced Assemblies are shown in Table 14 and Table 15; for additional formats refer to Appendix B.

Table 14 - Instance 100 - Default Produced IO Assembly

Instance 100 Parameter Based Input Assembly		
Byte	Word	Value
0	0	Value of parameter pointed to by parameter #61 (low byte)
1		Value of parameter pointed to by parameter #61 (high byte)
2	1	Value of parameter pointed to by parameter #62 (low byte)
3		Value of parameter pointed to by parameter #62 (high byte)
4	2	Value of parameter pointed to by parameter #63 (low byte)
5		Value of parameter pointed to by parameter #63 (high byte)
6	3	Value of parameter pointed to by parameter #64 (low byte)
7		Value of parameter pointed to by parameter #64 (high byte)

Table 15 - Instance 105 – E3 Plus Default Consumed I/O Assembly

Instance 103 E3 Plus Default Output Assembly								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0			Remote Trip			Fault Reset	Out B	Out A

Choosing the size and format of the I/O data that is exchanged by the EC4 Current Monitoring Relay is done by selecting Input and Output Assembly instance numbers. Each assembly has a given size (in bytes). This instance number is written to the Input Assembly and Output Assembly parameters. The different instances/formats allow for user programming flexibility and network optimization.

IMPORTANT	The <i>Output Assembly</i> and <i>Input Assembly</i> parameter values cannot be changed while the EC4 Current Monitoring Relay is online with a scanner. Any attempts to change the value of this parameter while online with a scanner will result in the error message "Object State Conflict".
------------------	---

Mapping to the Scanner's Scan List

The Automap feature available in all Rockwell Automation scanners automatically maps the information. If the default I/O Assemblies are not used, the values must be changed in the scanner's Scan List.

Do this by selecting "Edit I/O Parameters" on the Scan List tab of the scanner. The following screen (see Figure 31 -) then appears.

Figure 31 - Editing Device I/O Parameters

The screenshot shows a Windows-style dialog box titled "Edit I/O Parameters : A05, E3 Plus (9-5000A)". The dialog is divided into three main sections for different I/O modes:

- Strobed:** This section is currently disabled, indicated by a greyed-out checkbox. It contains an "Input Size" field set to 0 Bytes and a "Use Output Bit:" checkbox which is also disabled.
- Polled:** This section is active, indicated by a checked checkbox. It contains:
 - "Input Size:" set to 8 Bytes.
 - "Output Size:" set to 1 Bytes.
 - "Poll Rate:" set to "Every Scan" via a dropdown menu.
- Change of State / Cyclic:** This section is disabled. It contains radio buttons for "Change of State" (selected) and "Cyclic". Below them are:
 - "Input Size:" set to 8 Bytes.
 - "Output Size:" set to 1 Bytes.
 - "Heartbeat Rate:" set to 250 msec.
 - An "Advanced..." button.

At the bottom of the dialog are three buttons: "OK", "Cancel", and "Restore I/O Sizes".

Programmable Parameters

Introduction

This chapter describes each programmable parameter and its function.

Parameter Programming

Refer to **Chapter 4 — DeviceNet Node Commissioning** for instructions in using RSNetworx for DeviceNet to modify parameter settings. The section, *Device Parameter Programming — Input and Output Assemblies*, shows an example of modifying Parameters 59 and 60.

IMPORTANT	Parameter setting changes downloaded to the EC4 Current Monitoring Relay take effect immediately, even during a “running” status.
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IMPORTANT	Parameter setting changes made in a configuration tool such as RSNetWorx for DeviceNet do not take effect in the EC4 Current Monitoring Relay until the installer applies or downloads the new settings to the device.
------------------	--

Program Lock

Parameter 53, *Program Lock*, provides a degree of security from having parameter settings unintentionally altered when programmed to the “locked” setting.

Resetting to the Factory Default Values

Parameter 54, *Set to Defaults*, allows the installer to reset all parameter settings (including trip logs) to the factory default values.

IMPORTANT	Resetting to factory default values also resets the EC4 Current Monitoring Relay’s DeviceNet node address (MAC ID) to the default value of 63.
------------------	--

Parameter Group Listing

The EC4 Current Monitoring Relay contains six parameter groups. The parameters shown in the Advanced Setup, DeviceNet Setup, Output Setup, and Reset/Lock groups will be discussed in this chapter. The parameters in the Monitor group will be discussed in **Chapter 6 — Current Monitoring Parameters** and **Chapter 7 — Diagnostic Parameters**. The parameters in the Trip History and Snapshot groups will be discussed in **Chapter 9 — Logic Controller Application Example with Explicit Messaging**.

Table 16 - Parameter Group Listing

Monitor Params (All Read-Only)		Advanced Setup		Reset / Lock		DeviceNet Setup		Output Setup		DeviceLogix	
1	L1 Current (in Amps)	24	Trip Enable (Change bit masking)	26	Trip Reset (Ready/Reset Trip)	55	AutoBaudEnable (Enable/Disable)	65	OutA Pr FltState (Go to FltValue/ Ignore Fault)	79	Comm Override (Enabled/ Disabled)
2	L2 Current (in Amps)	25	Warning Enable	53	Program Lock (Unlock/Lock)	56	NonVol Baud Rate (125K, 250K, 500K Baud)	66	OutA Pr FltValue (Open/Closed)	80	Network Override (Enabled/ Disabled)
3	L3 Current (in Amps)	35	GF Inhibit Time (0...250 s)	54	Set To Defaults (Ready/Reset Defaults)	58	COS Mask (Bit Masking)	67	OutA Dn FltState (Go to FltValue/ Ignore Fault)	81	Net Outputs (Read-Only)
10	GF-Current (in Amps)	36	GF Trip Delay (0...25 s)	103	Test Enable (Enable/ Disable)	59	Output Assembly (0...140)	68	OutA Dn FltValue (Open/Closed)	82	Net Out COS Mask (Bit mask)
14	Trip Status	37	GF Trip Level (0.02...5 A)	104	Clear Queue (Ready/ Clear)	60	Input Assembly (0...184)	69	OutA Dn IdlState (Go to IdlValue/ Hold Last State)		
15	Warning Status	38	GF Warn Level (0.02...5 A)			61	Assy Word0 Param (0...130)	70	OutA Dn IdlValue (Open/Closed)		
16	Trip Log 0	83	IN1 Assignment (Normal, Trip Reset, Remote Trip, L1 Loss Arm, L2 Loss Arm, L3 Loss Arm, L1L2 Loss Arm, L2L3 Loss Arm, L1L3 Loss Arm, L1L2L3 Loss Arm)			62	Assy Word1 Param (0...130)	71	OutB Pr FltState (Go to FltValue/ Ignore Fault)		
17	Trip Log 1	84	IN2 Assignment			63	Assy Word2 Param (0...130)	72	OutB Pr FltValue (Open/Closed)		
18	Trip Log 2	85	IN3 Assignment			64	Assy Word3 Param (0...130)	73	OutB Dn FltState (Go to FltValue/ Ignore Fault)		
19	Trip Log 3	86	IN4 Assignment					74	OutB Dn FltValue (Open/Closed)		
20	Trip Log 4	89	GF Trip Inhibi (Enable/Disable)					75	OutB Dn IdlState (Go to IdlValue/ Hold Last State)		
21	Device Status	101	PM – # Starts (0...65535)					76	OutB Dn IdlValue (Open/Closed)		
22	Firmware	102	Oper. Hours (0...65535)								
23	Device Configuration	105	GF Warning Delay (0...25 s)								
90	Warning Log 0	106	GF Sensing Range (20...100 mA, 100...500 mA, 0.2...1 A, 1...5 A)								
91	Warning Log 1	107	UC Inhibit Time (0...250 s)								
92	Warning Log 2	108	L1 UC Trip Level								
93	Warning Log 3	109	L1 UC Trip Delay (0.1...25 s)								
94	Warning Log 4	110	L1 UC Warn Level								
95	Elapsed Time	111	L2 UC Trip Level								
96	Starts Counter	112	L2 UC Trip Delay (0.1...25 s)								
		113	L2 UC Warn Level								
		114	L3 UC Trip Level								

Table 17 - Parameter Group Listing, Continued

Monitor Params (All Read-Only)	Advanced Setup	Reset / Lock	DeviceNet Setup	Output Setup	DeviceLogix
	115 L3 UC Trip Delay (0.1...25 s)				
	116 L3 UC Warn Level				
	117 OC Inhibit Time (0...250 s)				
	118 L1 OC Trip Level				
	119 L1 OC Trip Delay (0.1...25 s)				
	120 L1 OC Warn Level				
	121 L2 OC Trip Level				
	122 L2 OC Trip Delay (0.1...25 s)				
	123 L2 OC Warn Level				
	124 L3 OC Trip Level				
	125 L3 OC Trip Delay (0.1...25 s)				
	126 L3 OC Warn Level				
	127 OC Inhibit Time (0...250 s)				
	128 L1 Loss Trip Delay (0.5...25 s)				
	129 L2 Loss Trip Delay (0.5...25 s)				
	130 L3 Loss Trip Delay (0.5...25 s)				

Table 18 - Parameter Group Listing, Continued

TripWarn History ❶		Trip Snapshot ❶	
132	Trip History 0	144	SS L1 Current
133	Trip History 1	145	SS L2 Current
134	Trip History 2	146	SS L3 Current
135	Trip History 3	148	SS GF Current
136	Trip History 4		
137	Warn History 0		
138	Warn History 1		
139	Warn History 2		
140	Warn History 3		
141	Warn History 4		
142	TripHistory Mask		
143	WarnHistory Mask		

❶ Series C (FRN 5.00 and Higher)

Advanced Setup Group

TRIP ENABLE This parameter allows the installer to enable or disable trip functions separately. Overload, Phase Loss, and Comm Fault are enabled from the factory. 1 = Enabled 0 = Disabled	Parameter Number	24
	Access Rule	Get/Set
	Data Type	WORD
	Object Mapping	0x29-1-124
	Group	Advanced Setup
	Units	—
	Minimum Value	0000000000000000
	Maximum Value	1111111111111111
	Default Value	0000000000000000

Bit																Function:	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
															X	Ground Fault	
														X		L1 Undercurrent	
													X			L2 Undercurrent	
												X				L3 Undercurrent	
											X					L1 Overcurrent	
										X						L2 Overcurrent	
									X							L3 Overcurrent	
								X								L1 Loss	
							X									L2 Loss	
						X										L3 Loss	
				X												Comm Fault	
			X													Comm Idle	
																—	
																—	
	X															Remote Trip	

WARNING ENABLE This parameter allows the installer to enable or disable warning functions separately. All warning functions are disabled from the factory. 1 = Enabled 0 = Disabled	Parameter Number	25
	Access Rule	Get/Set
	Data Type	WORD
	Object Mapping	0x29-1-125
	Group	Advanced Setup
	Units	—
	Minimum Value	0000000000000000
	Maximum Value	1111111111111111
	Default Value	0000000000000000

Bit																Function:
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
															X	Ground Fault
														X		L1 Undercurrent
													X			L2 Undercurrent
												X				L3 Undercurrent
										X						L1 Overcurrent
									X							L2 Overcurrent
								X								L3 Overcurrent
							X									L1 Loss
						X										L2 Loss
					X											L3 Loss
				X												Comm Fault
			X													Comm Idle
																—
		X														PM — #Starts
	X															PM — Oper. Hours

GF INHIBIT TIME This parameter defines the amount of time for which ground fault detection is inhibited during a motor starting sequence.	Parameter Number	35
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-135
	Group	Advanced Setup
	Units	Seconds
	Minimum Value	0
	Maximum Value	250
Default Value	10	

GF TRIP DELAY This parameter allows the installer to program a time duration for which a ground fault condition must exist at the programmed level prior to the device tripping.	Parameter Number	36
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-136
	Group	Advanced Setup
	Units	Seconds
	Minimum Value	0
	Maximum Value	25.0
Default Value	0.5	

GF Sensing Range This parameter selects one of the Ground Fault Sensing Ranges: 20...100 mA❶ 100...500 mA 200 mA...1.0 A 1.0...5.0 A ❶For use with resistive loads only. For motor loads, consult factory.	Parameter Number	106
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2Chex-1-181
	Group	Advanced Setup
	Units	0 = 20...100 mA 1 = 100...500 mA 2 = 200 mA...1.0 A 3 = 1.0...5.0 A
	Minimum Value	0
	Maximum Value	3
Default Value	3	

GF TRIP LEVEL This parameter sets the ground fault trip level.	Parameter Number	37
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-137
	Group	Advanced Setup
	Units	Amps
	Minimum Value	0.02
	Maximum Value	5.0
	Default Value	2.5
GF WARN LEVEL This parameter sets the ground fault warning level.	Parameter Number	38
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	0xB4-1-1 (E3) 2C _{hex} -1-138 (E3 Plus)
	Group	Advanced Setup
	Units	Amps
	Minimum Value	0.02
	Maximum Value	5.0
	Default Value	2.0
CT RATIO ❶ This parameter defines the turns ratio of the primary current transformers (when used). See Table 20 - on page 83 for the corresponding FLA setting ranges. ❶ FRN 2.000 and later.	Parameter Number	78
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	0x2-1-178
	Group	Overload Setup
	Units	—
	Minimum Value	0 = 50:5
		1 = 100:5
		2 = 150:5
		3 = 200:5
		4 = 300:5
		5 = 500:5
		6 = 600:5
		7 = 800:5
		8 = 1200:5
		9 = 2500:5
	Maximum Value	10 = 5000:5
	Default Value	0 = 50:5

IN1 ASSIGNMENT This parameter allows the user to assign a specific function to the discrete IN1 input.	Parameter Number	83
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	29 _{hex} -1-177
	Group	Advanced Setup
	Units	—
	Minimum Value	0 = Normal
		1 = Trip Reset
		2 = Remote Trip
		3 = L1 Loss Arm
		4 = L2 Loss Arm
		5 = L3 Loss Arm
		6 = L1 L2 Loss Arm
		7 = L2 L3 Loss Arm
		8 = L1 L3 Loss Arm
	Maximum Value	9 = L1 L2 L3 Loss Arm
	Default Value	0
IN2 ASSIGNMENT This parameter allows the user to assign a specific function to the discrete IN2 input.	Parameter Number	84
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	29 _{hex} -1-178
	Group	Advanced Setup
	Units	—
	Minimum Value	0 = Normal
		1 = Trip Reset
		2 = Remote Trip
		3 = L1 Loss Arm
		4 = L2 Loss Arm
		5 = L3 Loss Arm
		6 = L1 L2 Loss Arm
		7 = L2 L3 Loss Arm
		8 = L1 L3 Loss Arm
	Maximum Value	9 = L1 L2 L3 Loss Arm
	Default Value	0

IN3 ASSIGNMENT This parameter allows the user to assign a specific function to the discrete IN3 input.	Parameter Number	85
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	29 _{hex} -1-179
	Group	Advanced Setup
	Units	—
	Minimum Value	0 = Normal
		1 = Trip Reset
		2 = Remote Trip
		3 = L1 Loss Arm
		4 = L2 Loss Arm
		5 = L3 Loss Arm
IN4 ASSIGNMENT This parameter allows the user to assign a specific function to the discrete IN4 input.		6 = L1 L2 Loss Arm
		7 = L2 L3 Loss Arm
		8 = L1 L3 Loss Arm
	Maximum Value	9 = L1 L2 L3 Loss Arm
	Default Value	0
	Parameter Number	86
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	29 _{hex} -1-180
	Group	Advanced Setup
	Units	--
	Minimum Value	0 = Normal
GF TRIP INHIBIT This parameter allows the installer to inhibit a ground fault trip from occurring when the ground fault current exceeds the maximum range of the core balance sensor (approximately 10 A).		1 = Trip Reset
		2 = Remote Trip
		3 = L1 Loss Arm
		4 = L2 Loss Arm
		5 = L3 Loss Arm
		6 = L1 L2 Loss Arm
		7 = L2 L3 Loss Arm
		8 = L1 L3 Loss Arm
	Maximum Value	9 = L1 L2 L3 Loss Arm
	Default Value	0
	Parameter Number	89
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	
	Group	Advanced Setup
	Units	--
	Minimum Value	0 = Disabled
	Maximum Value	1 = Enabled
	Default Value	0

PM - # Starts This parameter allows the installer to set a number of starts after which preventative maintenance should be performed.	Parameter Number	101
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	29hex-1-106
	Group	Advanced Setup
	Units	—
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
GF Warn Delay This parameter allows the installer to program a time duration for which a ground fault condition must exist at the programmed level prior to the device providing a warning.	Parameter Number	105
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2Chex-1-180
	Group	Advanced Setup
	Units	Seconds
	Minimum Value	0
	Maximum Value	250
	Default Value	0
PM - Oper. Hours This parameter allows the installer to set the hours of operation after which preventative maintenance should be performed.	Parameter Number	102
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	29hex-1-107
	Group	Advanced Setup
	Units	Hours
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
UC Inhibit Time This parameter sets the time in which the under current protection is inhibited during a starting sequence.	Parameter Number	107
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-158
	Group	Advanced Setup
	Units	Seconds
	Minimum Value	0
	Maximum Value	250
	Default Value	1

L1 UC Trip Level This parameter sets the under current trip level for line 1.	Parameter Number	108
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	2C _{hex} -1-159 2C _{hex} -1-184 ❶
	Group	Advanced Setup
	Units	0.01 Amps 1 Amps ❶
	Minimum Value	0.20
	Maximum Value	5000
	Default Value	

❶ For Catalog Number 193-EC4ZZ

L1 UC Trip Delay This parameter allows the installer to program a time duration for which an under current condition must exist at the programmed level prior to the device tripping.	Parameter Number	109
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-160
	Group	Advanced Setup
	Units	0.1 Seconds
	Minimum Value	0.1
	Maximum Value	25.0
	Default Value	1.0

L1 UC Warn Level This parameter sets the under current warning level for line 1.	Parameter Number	110
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	2C _{hex} -1-161 2C _{hex} -1-118 ❶
	Group	Advanced Setup
	Units	0.01 Amps 1 Amps ❶
	Minimum Value	0.20
	Maximum Value	5000
	Default Value	

❶ For Catalog Number 193-EC4ZZ

L2 UC Trip Level This parameter sets the under current trip level for line 2.	Parameter Number	111
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	2C _{hex} -1-162 2C _{hex} -1-185 ❶
	Group	Advanced Setup
	Units	0.01 Amps 1 Amps ❶
	Minimum Value	0.20
	Maximum Value	5000
	Default Value	

❶ For Catalog Number 193-EC4ZZ

L2 UC Trip Delay This parameter allows the installer to program a time duration for which an under current condition must exist at the programmed level prior to the device tripping.	Parameter Number	112
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-163
	Group	Advanced Setup
	Units	0.1 Seconds
	Minimum Value	0.1
	Maximum Value	25.0
	Default Value	1.0

L2 UC Warn Level This parameter sets the under current warning level for line 2.	Parameter Number	113
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	2C _{hex} -1-164 2C _{hex} -1-119 ❶
	Group	Advanced Setup
	Units	0.01 Amps 1 Amps ❶
	Minimum Value	0.20
	Maximum Value	5000
	Default Value	

❶ For Catalog Number 193-EC4ZZ

L3 UC Trip Level This parameter sets the under current trip level for line 3.	Parameter Number	114
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	2C _{hex} -1-165 2C _{hex} -1-186 ❶
	Group	Advanced Setup
	Units	0.01 Amps 1 Amps ❶
	Minimum Value	0.20
	Maximum Value	5000
	Default Value	

❶ For Catalog Number 193-EC4ZZ

L3 UC Trip Delay This parameter allows the installer to program a time duration for which an under current condition must exist at the programmed level prior to the device tripping.	Parameter Number	115
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-166
	Group	Advanced Setup
	Units	0.1 Seconds
	Minimum Value	0.1
	Maximum Value	25.0
	Default Value	1.0

L3 UC Warn Level This parameter sets the under current warning level for line 3.	Parameter Number	116
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	2C _{hex} -1-167 2C _{hex} -1-120 ❶
	Group	Advanced Setup
	Units	0.01 Amps 1 Amps ❶
	Minimum Value	0.20
	Maximum Value	5000
	Default Value	

❶ For Catalog Number 193-EC4ZZ

OC Inhibit Time This parameter sets the time in which the over current protection is inhibited during a starting sequence.	Parameter Number	117
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-168
	Group	Advanced Setup
	Units	Seconds
	Minimum Value	0
	Maximum Value	250
	Default Value	1

L1 OC Trip Level This parameter sets the over current trip level for line 1.	Parameter Number	118
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	2C _{hex} -1-169 2C _{hex} -1-187 ❶
	Group	Advanced Setup
	Units	0.01 Amps 1 Amps ❶
	Minimum Value	0.20
	Maximum Value	5000
	Default Value	

❶ For Catalog Number 193-EC4ZZ

L1 OC Trip Delay This parameter allows the installer to program a time duration for which an over current condition must exist at the programmed level prior to the device tripping.	Parameter Number	119
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-170
	Group	Advanced Setup
	Units	0.1 Seconds
	Minimum Value	0.1
	Maximum Value	25.0
	Default Value	1.0

L1 OC Warn Level This parameter sets the over current warning level for line 1.	Parameter Number	120
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	2C _{hex} -1-171 2C _{hex} -1-121 ❶
	Group	Advanced Setup
	Units	0.01 Amps 1 Amps ❶
	Minimum Value	0.20
	Maximum Value	5000
	Default Value	

❶ For Catalog Number 193-EC4ZZ

L2 OC Trip Level This parameter sets the over current trip level for line 2.	Parameter Number	121
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	2C _{hex} -1-172 2C _{hex} -1-188 ❶
	Group	Advanced Setup
	Units	0.01 Amps 1 Amps ❶
	Minimum Value	0.20
	Maximum Value	5000
	Default Value	

❶ For Catalog Number 193-EC4ZZ

L2 OC Trip Delay This parameter allows the installer to program a time duration for which an over current condition must exist at the programmed level prior to the device tripping.	Parameter Number	122
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-173
	Group	Advanced Setup
	Units	0.1 Seconds
	Minimum Value	0.1
	Maximum Value	25.0
	Default Value	1.0

L2 OC Warn Level This parameter sets the over current warning level for line 2.	Parameter Number	123
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	2C _{hex} -1-174 2C _{hex} -1-122 ❶
	Group	Advanced Setup
	Units	0.01 Amps 1 Amps ❶
	Minimum Value	0.20
	Maximum Value	5000
	Default Value	

❶ For Catalog Number 193-EC4ZZ

L3 OC Trip Level This parameter sets the over current trip level for line 3.	Parameter Number	124
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	2C _{hex} -1-175 2C _{hex} -1-189 ❶
	Group	Advanced Setup
	Units	0.01 Amps 1 Amps ❶
	Minimum Value	0.20
	Maximum Value	5000
	Default Value	

❶ For Catalog Number 193-EC4ZZ

L3 OC Trip Delay This parameter allows the installer to program a time duration for which an over current condition must exist at the programmed level prior to the device tripping.	Parameter Number	125
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-176
	Group	Advanced Setup
	Units	0.1 Seconds
	Minimum Value	0.1
	Maximum Value	25.0
	Default Value	1.0

L3 OC Warn Level This parameter sets the over current warning level for line 3.	Parameter Number	126
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	2C _{hex} -1-177 2C _{hex} -1-123 ❶
	Group	Advanced Setup
	Units	0.01 Amps 1 Amps ❶
	Minimum Value	0.20
	Maximum Value	5000
	Default Value	

❶ For Catalog Number 193-EC4ZZ

LL Inhibit Time This parameter sets the time in which line loss protection is inhibited during a starting sequence.	Parameter Number	127
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-114
	Group	Advanced Setup
	Units	0.1 Seconds
	Minimum Value	0.0
	Maximum Value	25.0
	Default Value	0.1

L1 Loss Trip Delay This parameter allows the installer to program a time duration for which a loss on line 1 must exist prior to the device tripping.	Parameter Number	128
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-115
	Group	Advanced Setup
	Units	0.1 Seconds
	Minimum Value	0.5
	Maximum Value	25.0
	Default Value	0.5

L2 Loss Trip Delay This parameter allows the installer to program a time duration for which a loss on line 2 must exist prior to the device tripping.	Parameter Number	129
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-116
	Group	Advanced Setup
	Units	0.1 Seconds
	Minimum Value	0.5
	Maximum Value	25.0
	Default Value	0.5

L3 Loss Trip Delay This parameter allows the installer to program a time duration for which a loss on line 3 must exist prior to the device tripping.	Parameter Number	130
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	2C _{hex} -1-117
	Group	Advanced Setup
	Units	0.1 Seconds
	Minimum Value	0.5
	Maximum Value	25.0
	Default Value	0.5

Reset/Lock Group

TRIP RESET This parameter provides the user with the capability of resetting a trip over the DeviceNet network. After a trip is reset, the parameter automatically returns to a "Ready" state.	Parameter Number	26
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x29-1-126
	Group	Reset/Lock
	Units	—
	Minimum Value	0 = Ready
	Maximum Value	1 = Reset
	Default Value	0

PROGRAM LOCK This parameter prohibits the device parameters from being altered when set to "Locked". This parameter must be set to "Unlocked" to allow parameter modification.	Parameter Number	53
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0xB4-1-18
	Group	Reset/Lock
	Units	—
	Minimum Value	0 = Unlocked
	Maximum Value	1 = Locked
	Default Value	0
SET TO DEFAULTS This parameter allows the user to reset the parameter settings to the factory default values. After parameter values have been reset to the factory default settings, the parameter automatically returns to a "Ready" state.	Parameter Number	54
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0xB4-1-19
	Group	Reset/Lock
	Units	—
	Minimum Value	0 = Ready
	Maximum Value	1 = Set
	Default Value	0
Test Enable This parameter allows the installer to enable or disable the test function of the Test/Reset button.	Parameter Number	103
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	29hex-1-108
	Group	Reset/Lock
	Units	—
	Minimum Value	0 = Disable
	Maximum Value	1 = Enable
	Default Value	1
Clear Queue This parameter allows the user to clear the Trip Logs, Warning Logs, Starts Counter, and the Elapsed Time. Setting the Clear Queue parameter to "1" will clear/reset the Trip Logs, Warning Logs, Starts Counter, and the Elapsed Time parameters at the same time.	Parameter Number	104
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	29hex-1-132
	Group	Reset/Lock
	Units	—
	Minimum Value	0 = Ready
	Maximum Value	1 = Clear
	Default Value	0

DeviceNet Setup Group

AUTO BAUD ENABLE When this parameter is enabled, the device will attempt to determine the network baud rate and set its baud rate to the same, provided network traffic exists. At least one node with an established baud rate must exist on the network for autobaud to occur.	Parameter Number	55
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0xB4-1-15
	Group	DeviceNet Setup
	Units	—
	Minimum Value	0 = Disabled
	Maximum Value	1 = Enabled
	Default Value	1

NONVOL BAUD RATE This parameter allows the installer to manually set the desired baud rate. Parameter 55, <i>AutoBaud Enable</i> , must be disabled when using this parameter.	Parameter Number	56
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	0xB4-1-6
	Group	DeviceNet Setup
	Units	—
	Minimum Value	0 = 125k 1 = 250k
	Maximum Value	2 = 500k
	Default Value	0

COS MASK This parameter allows the installer to define the change-of-state conditions that will result in a change-of-state message being produced. 1 = Enabled 0 = Disabled	Parameter Number	58
	Access Rule	Get/Set
	Data Type	WORD
	Object Mapping	0xB4-1-13
	Group	DeviceNet Setup
	Units	—
	Minimum Value	0000000000000000
	Maximum Value	0000001111111111
	Default Value	0000000000000000

Bit																Function:
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
															X	Trip
														X		Warning
													X			Output A
												X				Output B (E3 Plus)
											X					Input #1
										X						Input #2
									X							Input #3 (E3 Plus)
								X								Input #4 (E3 Plus)
							X									Motor Current
					X											Ground Fault Current (E3 Plus)

OUTPUT ASSEMBLY This parameter is used to select the desired output assembly. See Appendix B for a listing of available assemblies	Parameter Number	59
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	0xB4-1-16
	Group	DeviceNet Setup
	Units	—
	Minimum Value	0
	Maximum Value	105
	Default Value	103 (E3) 105 (E3 Plus)

INPUT ASSEMBLY This parameter is used to select the desired input assembly. See Appendix B for a listing of available assemblies	Parameter Number	60
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	0xB4-1-17
	Group	DeviceNet Setup
	Units	—
	Minimum Value	0
	Maximum Value	107
	Default Value	100
ASSY WORD0 PARAM This parameter assigns the parameter value to be placed in Word 0 of Input Assembly 100.	Parameter Number	61
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	0xB4-1-7
	Group	DeviceNet Setup
	Units	—
	Minimum Value	0
	Maximum Value	89
	Default Value	21
ASSY WORD1 PARAM This parameter assigns the parameter value to be placed in Word 1 of Input Assembly 100.	Parameter Number	62
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	0xB4-1-8
	Group	DeviceNet Setup
	Units	—
	Minimum Value	0
	Maximum Value	89
	Default Value	1
ASSY WORD2 PARAM This parameter assigns the parameter value to be placed in Word 2 of Input Assembly 100.	Parameter Number	63
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	0xB4-1-9
	Group	DeviceNet Setup
	Units	—
	Minimum Value	0
	Maximum Value	89
	Default Value	2
ASSY WORD3 PARAM This parameter assigns the parameter value to be placed in Word 3 of Input Assembly 100.	Parameter Number	64
	Access Rule	Get/Set
	Data Type	USINT
	Object Mapping	0xB4-1-10
	Group	DeviceNet Setup
	Units	—
	Minimum Value	0
	Maximum Value	89
	Default Value	3

Output Setup Group

IMPORTANT The parameters in the Output Setup Group provide great flexibility in terms of output relay(s) operation under the conditions of Protection Faults, Comm Fault, and Comm Idle. It is important, therefore, that the installer fully understands the use of these parameters, their interaction with Parameter 24, *Trip Enable*, and the order of priority.

Order of Priority: The *Out_Pr FltState* parameter settings take priority over the other settings.

If Comm Fault and Comm Idle are enabled (set to 1) in *Trip Enable*, the state that the output(s) assumes is first determined by the settings in the *Out_Pr FltState* and *Out_Pr FltValue* parameters. If *Out_Pr FltState* is set to 1 = ignore fault, the state of the output(s) will be determined by the *Out_DN FltState* and *Out_DN FltValue*, and *Out_DN IdlState* and *Out_DN IdlValue* settings.

If Comm Fault and Comm Idle are disabled (set to 0) in *Trip Enable*, the state that the output(s) assumes will be determined by the *Out_DN FltState* and *Out_DN Flt Value*, and *Out_DN IdlState* and *Out_DN IdlValue* settings.

EC4 is normal – no trip present

In normal operation, the EC4 Current Monitoring Relay firmware latches Out A and Out B commands received through Polled I/O and Explicit messaging. The latched states are applied to the outputs until the next command is received.

EC4 is tripped

In the event of a protection trip, the state of an EC4 Current Monitoring Relay output is determined by the programmed settings of the corresponding *Out_Pr FltState* and *Out_Pr FltValue* parameters. When *Out_Pr FltState* is set to “Ignore Fault”, output operation continues to respond to message commands. When *Out_Pr FltState* is set to “Go to FltValue”, the output commanded states are determined by the settings of the *Out_Pr FltValue* parameters.

The EC4 current monitoring relay sets the firmware latch to the *Out_Pr FltValue* when *Out_Pr FltState* is set to “Go to FltValue” while the EC4 Current Monitoring Relay is in a tripped state.

EC4 is reset from trip

After an EC4 Current Monitoring Relay is returned to normal following a trip reset, operation of Out A and Out B is determined by the state of the firmware latch. Table 19 provides further illustration.

Table 19 - Output State Matrix for Output Setup Parameters

Commanded Output State Prior to Trip	Out X PR FltState Setting	Out X PR FltValue Setting	Output State with Active Trip	Last Commanded Output State during Trip	Output State Following Trip Reset (before any new command)
Open	0 = Go to FltValue	0 = Open	Open	Open	Open
				Close	Open
				-none -	Open
		1 = Closed	Closed	Open	Closed
				Close	Closed
				-none -	Closed
	1 = Ignore Fault	—	As Commanded	As Commanded	As Commanded
Close	0 = Go to FltValue	0 = Open	Open	Open	Open
				Close	Open
				-none -	Open
		1 = Closed	Closed	Open	Closed
				Close	Closed
				-none -	Closed
	1 = Ignore Fault	—	As Commanded	As Commanded	As Commanded

OUTA PR FLTSTATE This parameter, in conjunction with Parameter 66, defines how Output A will respond when a trip occurs. When set to “1”, Output A will continue to operate as commanded via the network. When set to “0”, Output A will open or close as determined by the setting of Parameter 66.	Parameter Number	65
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x09-1-113
	Group	DeviceNet I/O
	Units	—
	Minimum Value	0 = Go to FltValue (#66)
	Maximum Value	1 = Ignore Fault
	Default Value	0
OUTA PR FLTVALUE This parameter determines the state that Output A assumes when a trip occurs and Parameter 65 is set to “0”.	Parameter Number	66
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x09-1-114
	Group	DeviceNet I/O
	Units	—
	Minimum Value	0 = Open
	Maximum Value	1 = Closed
	Default Value	0

OUTA DN FLTSTATE This parameter, in conjunction with Parameter 68, defines how Output A will respond when a DeviceNet network fault occurs. When set to “1”, Output A will hold the state prior to trip occurrence. When set to “0”, Output A will open or close as determined by the setting of Parameter 68. Output A can be configured to go to a desired state in the event of a DeviceNet network fault independent from enabling CommFault in Parameter 24, <i>Trip Enable</i>.	Parameter Number	67
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x09-1-5
	Group	DeviceNet I/O
	Units	—
	Minimum Value	0 = Go to FltValue (#68)
	Maximum Value	1 = Hold Last State
	Default Value	0
OUTA DN FLTVALUE This parameter determines the state that Output A assumes when a DeviceNet network fault occurs and Parameter 67 is set to “0”.	Parameter Number	68
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x09-1-6
	Group	DeviceNet I/O
	Units	—
	Minimum Value	0 = Open
	Maximum Value	1 = Closed
	Default Value	0
OUTA DN IDLSTATE This parameter, in conjunction with Parameter 70, defines how Output A will respond when the DeviceNet network is idle. When set to “1”, Output A will hold the state prior to trip occurrence. When set to “0”, Output A will open or close as determined by the setting in Parameter 70. The Dn Flt parameters supersede the Dn Idl parameters.	Parameter Number	69
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x09-1-7
	Group	DeviceNet I/O
	Units	—
	Minimum Value	0 = Go to IdlValue (#70)
	Maximum Value	1 = Hold Last State
	Default Value	0
OUTA DN IDLVALUE This parameter determines the state that Output A assumes when the network is idle and Parameter 69 is set to “0”.	Parameter Number	70
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x09-1-8
	Group	Advanced Setup
	Units	—
	Minimum Value	0 = Open
	Maximum Value	1 = Closed
	Default Value	0
OUTB PR FLTSTATE This parameter, in conjunction with Parameter 72, defines how Output B will respond when a trip occurs. When set to “1”, Output B will continue to operate as commanded via the network. When set to “0”, Output B will open or close as determined by the setting in Parameter 72.	Parameter Number	71
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x09-2-113
	Group	DeviceNet I/O
	Units	—
	Minimum Value	0 = Go to FltValue (#72)
	Maximum Value	1 = Ignore Fault
	Default Value	0

OUTB PR FLTVALUE This parameter determines the state that Output B assumes when a trip occurs and Parameter 71 is set to "0".	Parameter Number	72
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x09-2-114
	Group	DeviceNet I/O
	Units	—
	Minimum Value	0 = Open
	Maximum Value	1 = Closed
	Default Value	0
OUTB DN FLTSTATE This parameter, in conjunction with Parameter 74, defines how Output B will respond when a DeviceNet network fault occurs. When set to "1", Output B will hold the state prior to trip occurrence. When set to "0", Output B will open or close as determined by the setting in Parameter 74. Output B can be configured to go to a desired state in the event of a DeviceNet network fault independent from enabling CommFault in Parameter 24, Trip Enable.	Parameter Number	73
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x09-2-5
	Group	DeviceNet I/O
	Units	—
	Minimum Value	0 = Go to FltValue (#74)
	Maximum Value	1 = Hold Last State
	Default Value	0
OUTB DN FLTVALUE This parameter determines the state that Output B assumes when a comm fault occurs and Parameter 73 is set to "0".	Parameter Number	74
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x09-2-6
	Group	DeviceNet I/O
	Units	—
	Minimum Value	0 = Open
	Maximum Value	1 = Closed
	Default Value	0
OUTB DN IDLSTATE This parameter, in conjunction with Parameter 76, defines how Output B will respond when the DeviceNet network is idle. When set to "1", Output B will hold the state prior to trip occurrence. When set to "0", Output B will open or close as determined by the setting in Parameter 76. The Dn Flt parameters supersede the Dn Idl parameters.	Parameter Number	75
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x09-2-7
	Group	DeviceNet I/O
	Units	—
	Minimum Value	0 = Go to IdlValue (#76)
	Maximum Value	1 = Hold Last State
	Default Value	0
OUTB DN IDLVALUE This parameter determines the state that Output B assumes when the network is idle and Parameter 75 is set to "0".	Parameter Number	76
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x09-2-8
	Group	DeviceNet I/O
	Units	—
	Minimum Value	0 = Open
	Maximum Value	1 = Closed
	Default Value	0

DeviceLogix Group

COMM OVERRIDE This parameter is used to enable DeviceLogix programs to override normal output behavior in the event of a communication status change. These events include all states where the E3 Plus is without an I/O connection (I/O Connection does not exist, has timed out, has been deleted, or is currently idle)	Parameter Number	79
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x1E-1-105
	Group	DeviceLogix
	Units	—
	Minimum Value	0 = Disabled
	Maximum Value	1 = Enabled
	Default Value	0

NETWORK OVERRIDE This parameter is used to enable DeviceLogix programs to override normal output behavior in the event of a network fault. Network faults include duplicate MAC ID failures and bus off conditions.	Parameter Number	80
	Access Rule	Get/Set
	Data Type	BOOL
	Object Mapping	0x1E-1-104
	Group	DeviceLogix
	Units	—
	Minimum Value	0 = Disabled
	Maximum Value	1 = Enabled
	Default Value	0

NET OUTPUTS This parameter monitors network outputs controlled through DeviceLogix programs.	Parameter Number	81
	Access Rule	Get/Set
	Data Type	WORD
	Object Mapping	0x04-1-3
	Group	DeviceLogix
	Units	—
	Minimum Value	
	Maximum Value	
	Default Value	

Bits																Function:
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
															X	Net Output 0
														X		Net Output 1
													X			Net Output 2
												X				Net Output 3
											X					Net Output 4
										X						Net Output 5
									X							Net Output 6
								X								Net Output 7
							X									Net Output 8
						X										Net Output 9
					X											Net Output 10
				X												Net Output 11
			X													Net Output 12
		X														Net Output 13
	X															Net Output 14
X																—

NET OUT COS MASK This parameter allows the installer to select the events for which a Change-of-State (COS) message is produced. 1 = Enabled 0 = Disabled	Parameter Number	82
	Access Rule	Get/Set
	Data Type	WORD
	Object Mapping	0xB4-1-50
	Group	DeviceLogix
	Units	—
	Minimum Value	
	Maximum Value	
	Default Value	

Bits																Function:
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
														X		Net Output 0
														X		Net Output 1
													X			Net Output 2
												X				Net Output 3
											X					Net Output 4
									X							Net Output 5
								X								Net Output 6
							X									Net Output 7
						X										Net Output 8
					X											Net Output 9
				X												Net Output 10
			X													Net Output 11
		X														Net Output 12
	X															Net Output 13
X																Net Output 14
																—

Current Monitoring Parameters

Introduction

This chapter provides information for the current monitoring parameters of the EC4 Current Monitoring Relay.

Phase Current Reporting

Current Range

The EC4 Current Monitoring Relay utilizes a true RMS algorithm to calculate the RMS value of the current passing through phase L1, L2, and L3. The relay is capable of sensing and reporting currents ranging from 0% to 720% of the maximum current rating.

IMPORTANT The EC4 Current Monitoring Relay will report 0 A if the current is below 30% of the minimum current rating.

IMPORTANT The EC4 Current Monitoring Relay is capable of reporting values greater than 720% of the maximum current rating, but the accuracy of the value may be compromised.

The following chart illustrates the reporting current precision, the minimum and maximum reporting current values, and the 720% maximum current rating value for each current range.

Table 20 - Current Reporting Summary (with indicated precision)

FLA Setting Range [A]	CT Ratio	Min. Reporting Current [A] ❶	Max Reporting Current [A] ❷
0.4...2.0	—	0.15	14.40
1...5	—	0.30	36.00
3...15	—	0.90	108.00
5...25	—	1.50	180.00
9...45	—	3.0	360.0
18...90	—	6.0	720.0
9...45	50:5	3	360
18...90	100:5	6	720
28...140	150:5	9	1080
42...210	200:5	12	1440
60...302	300:5	18	2160
84...420	500:5	30	3600
125...630	600:5	36	4320
172...860	800:5	48	5760
240...1215	1200:5	72	8640
450...2250	2500:5	150	18000
1000...5000	5000:5	300	32767

❶ 0 A is reported when the actual current is below the indicated minimum reporting current.

❷ The E3 is capable of reporting higher currents, but reporting accuracy is compromised.

Reporting Accuracy

Table 21 - Current Reporting Accuracy

FLA Setting Range	Operating Range	
	100% Min. current rating... 720% Max. current rating	50% Min. current rating... 100% Min. current rating
0.4...2.0 A	±10%	—
All others	±6%	±10%

IMPORTANT The accuracy specified above is only applicable to non-distorted sinusoidal currents.

Ground Fault Current Reporting

Current Range

The following chart illustrates the minimum and maximum reporting ground fault current values for a given ground fault current range.

Table 22 - Ground Fault Current Reporting Summary

Ground Fault Current Range	Minimum Reporting Current ❶❸	Maximum Reporting Current ❷❸	E3 Plus Cat. No. /Series
20...100 mA❹	10 mA	180 mA	193/592-EC3 — Series C and later
100...500 mA	50 mA	900 mA	193/592-EC3 — Series C and later
200 mA...1.0 A	100 mA	1.80 A	193/592-EC3 — Series C and later
1.0...5.0 A	500 mA	9.00 A	193/592-EC2 — Series A and later

- ❶ The EC4 Current Monitoring Relay will report 0 A if the ground fault current is below 50% of the minimum ground fault current setting for a given range.
- ❷ The EC4 Current Monitoring Relay is capable of reporting values greater than the maximum values shown, but the accuracy of the value is compromised.
- ❸ The accuracy specified is only applicable to non-distorted sinusoidal currents.
- ❹ 20...100 mA for resistive loads only. For motor loads consult your local Allen-Bradley distributor.

Frequency Range

The EC4 Current Monitoring Relay is capable of sensing variable frequency ground fault currents ranging from 20...250 Hz.

Exception: Any EC4 Current Monitoring Relay using an external ground fault sensor is limited to 50/60 Hz detection.

Monitor Group

L1 CURRENT This parameter provides the L1 phase current measurement in amperes.	Parameter Number	1
	Access Rule	Get
	Data Type	INT
	Object Mapping	2C _{hex} -1-231 2C _{hex} -1-8 2C _{hex} -1-227
	Group	Monitor
	Units	Amps
	Minimum Value	See Table 20 -
	Maximum Value	See Table 20 -
	Default Value	None

L2 CURRENT This parameter provides the L2 phase current measurement in amperes.	Parameter Number	2
	Access Rule	Get
	Data Type	INT
	Object Mapping	2C _{hex} -1-232 2C _{hex} -1-9 2C _{hex} -1-228
	Group	Monitor
	Units	Amps
	Minimum Value	See Table 20 -
	Maximum Value	See Table 20 -
	Default Value	None
L3 CURRENT This parameter provides the L3 phase current measurement in amperes.	Parameter Number	3
	Access Rule	Get
	Data Type	INT
	Object Mapping	2C _{hex} -1-233 2C _{hex} -1-10 2C _{hex} -1-229
	Group	Monitor
	Units	Amps
	Minimum Value	See Table 20 -
	Maximum Value	See Table 20 -
	Default Value	None
GF CURRENT This parameter provides the ground fault current measurement in amperes.	Parameter Number	10
	Access Rule	Get
	Data Type	INT
	Object Mapping	2C _{hex} -1-110
	Group	Monitor
	Units	Amps
	Minimum Value	0.00
	Maximum Value	12.75 (approx.)
	Default Value	None

Diagnostic Parameters

Introduction

This chapter provides an overview of the diagnostic and status parameters reported by the EC4 Current Monitoring Relay.

Monitor Group

TRIP STATUS This parameter provides trip identification. 1 = Trip 0 = No Trip	Parameter Number	14
	Access Rule	Get
	Data Type	WORD
	Object Mapping	0x29-1-114
	Group	Monitor
	Units	—
	Minimum Value	—
	Maximum Value	—
	Default Value	None

Bits																Function:	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
															X	Ground Fault	
														X		L1 Undercurrent	
													X			L2 Undercurrent	
											X					L3 Undercurrent	
										X						L1 Overcurrent	
									X							L2 Overcurrent	
							X									L3 Overcurrent	
								X								L1 Loss	
							X									L2 Loss	
					X											L3 Loss	
				X												Comm Fault	
			X													Comm Idle	
		X														Hardware Fault	
	X															Test Trip	
X																Remote Trip	
																NonVol Mem Fault	

WARNING STATUS This parameter provides warning identification.	Parameter Number	15
	Access Rule	Get
	Data Type	WORD
	Object Mapping	0x29-1-115
	Group	Monitor
	Units	—
	Minimum Value	—
	Maximum Value	—
	Default Value	None

Bit																Function:
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
																Ground Fault
														X		L1 Undercurrent
													X			L2 Undercurrent
												X				L3 Undercurrent
											X					L1 Overcurrent
										X						L2 Overcurrent
									X							L3 Overcurrent
								X								L1 Loss
							X									L2 Loss
						X										L3 Loss
				X												Comm Fault
			X													Comm Idle
		X														Config Fault
	X															PM - # Starts
X																PM – Oper. Hours

TRIP LOG 0 This parameter records the latest trip.	Parameter Number	16
	Access Rule	Get
	Data Type	WORD
	Object Mapping	0x29-1-116
	Group	Monitor
	Units	—
	Minimum Value	See table
	Maximum Value	See table
	Default Value	None

TRIP LOG 1 This parameter records the trip previous to Trip Log 0.	Parameter Number	17
	Access Rule	Get
	Data Type	WORD
	Object Mapping	0x29-1-117
	Group	Monitor
	Units	—
	Minimum Value	See Trip Status table
	Maximum Value	See Trip Status table
	Default Value	None

TRIP LOG 2 This parameter records the trip previous to Trip Log 1.	Parameter Number	18
	Access Rule	Get
	Data Type	WORD
	Object Mapping	0x29-1-118
	Group	Monitor
	Units	—
	Minimum Value	See Trip Status table
	Maximum Value	See Trip Status table
	Default Value	None

TRIP LOG 3 This parameter records the trip previous to Trip Log 2.	Parameter Number	19
	Access Rule	Get
	Data Type	WORD
	Object Mapping	0x29-1-119
	Group	Monitor
	Units	—
	Minimum Value	See Trip Status table
	Maximum Value	See Trip Status table
	Default Value	None

TRIP LOG 4 This parameter records the trip previous to Trip Log 3.	Parameter Number	20
	Access Rule	Get
	Data Type	WORD
	Object Mapping	0x29-1-120
	Group	Monitor
	Units	—
	Minimum Value	See Trip Status table
	Maximum Value	See Trip Status table
	Default Value	None

DEVICE STATUS This parameter provides status information of the EC4 Current Monitoring Relay as outlined in the table below. 1 = On or Present 0 = Off or Not Present	Parameter Number	21
	Access Rule	Get
	Data Type	WORD
	Object Mapping	0x29-1-121
	Group	Monitor
	Units	—
	Minimum Value	—
	Maximum Value	—
	Default Value	None

Bit																Function:	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
															X	Trip	
														X		Warning	
													X			Output A	
											X					Output B (E3 Plus)	
										X						Input #1	
									X							Input #2	
								X								Input #3 (E3 Plus)	
							X									Input #4 (E3 Plus)	
						X										Motor Current	
					X											Ground Fault Current (E3 Plus)	

Firmware	Parameter Number	22
This parameter allows the installer to read the firmware revision number (FRN) of the E3 Overload Relay.	Access Rule	Get
	Data Type	UINT
	Object Mapping	B4hex-01-0C
	Group	Monitor
	Units	—
	Minimum Value	0
	Maximum Value	65535
	Default Value	—

Dev Config	Parameter Number	23
This parameter allows the installer to read which features are enabled in the E3 Overload Relay as outlined in the table below: 1 = On or Present 0 = Off or Not Present	Access Rule	Get
	Data Type	UINT
	Object Mapping	B4hex-01-14
	Group	Monitor
	Units	—
	Minimum Value	—
	Maximum Value	—
	Default Value	—

Bit																Function:	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	4 in/2 out PTC Hardware GF Hardware External GF Heat Trace	
															X		
														X			
												X					
											X						
											X						

Warn Log 0	Parameter Number	90
This parameter records the latest warning.	Access Rule	Get
	Data Type	WORD
	Object Mapping	29hex-1-109
	Group	Monitor
	Units	—
	Minimum Value	See Warning Status Table
	Maximum Value	See Warning Status Table
	Default Value	0

Warn Log 1	Parameter Number	91
This parameter records the warning previous to Warn Log 0.	Access Rule	Get
	Data Type	WORD
	Object Mapping	29hex-1-110
	Group	Monitor
	Units	—
	Minimum Value	See Warning Status Table
	Maximum Value	See Warning Status Table
	Default Value	0

Warn Log 2 This parameter records the warning previous to Warn Log 1.	Parameter Number	92
	Access Rule	Get
	Data Type	WORD
	Object Mapping	29hex-1-111
	Group	Monitor
	Units	—
	Minimum Value	See Warning Status Table
	Maximum Value	See Warning Status Table
	Default Value	0
Warn Log 3 This parameter records the warning previous to Warn Log 2.	Parameter Number	93
	Access Rule	Get
	Data Type	WORD
	Object Mapping	29hex-1-112
	Group	Monitor
	Units	—
	Minimum Value	See Warning Status Table
	Maximum Value	See Warning Status Table
	Default Value	0
Warn Log 4 This parameter records the warning previous to Warn Log 3.	Parameter Number	94
	Access Rule	Get
	Data Type	WORD
	Object Mapping	29hex-1-113
	Group	Monitor
	Units	—
	Minimum Value	See Warning Status Table
	Maximum Value	See Warning Status Table
	Default Value	0
Elapsed Time This parameter records the hours of motor operation - the time period that the E3 is sensing motor current present (motor current must be greater than 30% of the minimum current rating).	Parameter Number	95
	Access Rule	Get
	Data Type	UINT
	Object Mapping	29hex-1-100
	Group	Monitor
	Units	Hours
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
Starts Counter This parameter records the number of starts - motor current transitions from zero to non-zero values (motor current must be greater than 30% of the minimum current rating).	Parameter Number	96
	Access Rule	Get
	Data Type	UINT
	Object Mapping	29hex-1-101
	Group	Monitor
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0

Trip History and Snapshot

Trip and Warning History

The EC4 Current Monitoring Relay with firmware revision 5.01 and higher offers the user programmable Trip History and Warning History diagnostic information. The user can select the specific trip and warning features that get written to the five record Trip History and Warning History.

TripWarn History Group

Trip History 0 This parameter reports the latest trip written to the Trip History. Refer to Table 8.1 for the Trip History record identification.	Parameter Number	132
	Access Rule	Get
	Data Type	UINT
	Object Mapping	0Fhex-84-01
	Group	TripWarn History
	Units	—
	Minimum Value	0
	Maximum Value	48
	Default Value	—
Trip History 1 This parameter reports the trip written to the Trip History previous to Trip History 0. Refer to Table 8.1 for the Trip History record identification.	Parameter Number	133
	Access Rule	Get
	Data Type	UINT
	Object Mapping	0Fhex-85-01
	Group	TripWarn History
	Units	—
	Minimum Value	0
	Maximum Value	48
	Default Value	—
Trip History 2 This parameter reports the trip written to the Trip History previous to Trip History 1. Refer to Table 8.1 for the Trip History record identification.	Parameter Number	134
	Access Rule	Get
	Data Type	UINT
	Object Mapping	0Fhex-86-01
	Group	TripWarn History
	Units	—
	Minimum Value	0
	Maximum Value	48
	Default Value	—

Trip History 3 This parameter reports the trip written to the Trip History previous to Trip History 2. Refer to Table 8.1 for the Trip History record identification.	Parameter Number	135
	Access Rule	Get
	Data Type	UINT
	Object Mapping	0Fhex-87-01
	Group	TripWarn History
	Units	—
	Minimum Value	0
	Maximum Value	48
	Default Value	—
Trip History 4 This parameter reports the trip written to the Trip History previous to Trip History 3. Refer to Table 8.1 for the Trip History record identification.	Parameter Number	136
	Access Rule	Get
	Data Type	UINT
	Object Mapping	0Fhex-88-01
	Group	TripWarn History
	Units	—
	Minimum Value	0
	Maximum Value	48
	Default Value	—
Warn History 0 This parameter reports the latest warning written to the Warning History. Refer to Table 8.1 for the Warning History record identification.	Parameter Number	137
	Access Rule	Get
	Data Type	UINT
	Object Mapping	0Fhex-89-01
	Group	TripWarn History
	Units	—
	Minimum Value	0
	Maximum Value	48
	Default Value	—
Warn History 1 This parameter reports the warning written to the Warning History previous to Warn History 0. Refer to Table 8.1 for the Warning History record identification.	Parameter Number	138
	Access Rule	Get
	Data Type	UINT
	Object Mapping	0Fhex-8A-01
	Group	TripWarn History
	Units	—
	Minimum Value	0
	Maximum Value	48
	Default Value	—
Warn History 2 This parameter reports the warning written to the Warning History previous to Warn History 1. Refer to Table 8.1 for the Warning History record identification.	Parameter Number	139
	Access Rule	Get
	Data Type	UINT
	Object Mapping	0Fhex-8B-01
	Group	TripWarn History
	Units	—
	Minimum Value	0
	Maximum Value	48
	Default Value	—

Warn History 3 This parameter reports the warning written to the Warning History previous to Warn History 2. Refer to Table 8.1 for the Warning History record identification.	Parameter Number	140
	Access Rule	Get
	Data Type	UINT
	Object Mapping	0Fhex-8C-01
	Group	TripWarn History
	Units	—
	Minimum Value	0
	Maximum Value	48
	Default Value	—
Warn History 4 This parameter reports the warning written to the Warning History previous to Warn History 3. Refer to Table 8.1 for the Warning History record identification.	Parameter Number	141
	Access Rule	Get
	Data Type	UINT
	Object Mapping	0Fhex-8D-01
	Group	TripWarn History
	Units	—
	Minimum Value	0
	Maximum Value	48
	Default Value	—

Trip History Codes

Code	Type	Description
0	No Fault	No Fault Conditions Detected
1	Ground Fault	Power conductor or motor winding is shorting to ground
2	L1 Undercurrent	Line 1 current is lower than the programmed level
3	L2 Undercurrent	Line 2 current is lower than the programmed level
4	L3 Undercurrent	Line 3 current is lower than the programmed level
5	L1 Overcurrent	Line 1 current exceeds the programmed level
6	L2 Overcurrent	Line 2 current exceeds the programmed level
7	L3 Overcurrent	Line 3 current exceeds the programmed level
8	L1 Loss	Current in line 1 is not present
9	L2 Loss	Current in line 2 is not present
10	L3 Loss	Current in line 3 is not present
11	Comm Fault	DeviceNet communications fault detected
12	Comm Idle	DeviceNet idle condition detected
13	Hardware Fault	Hardware configuration fault. Check for shorts on input terminal
14	Test Trip	Test trip caused by holding the Test/Reset button for 2 seconds
15	Remote Trip	Remote trip command detected
16	NonVol Mem Fault	Internal memory failure. Contact the factory.

Warning History Codes

Code	Type	Description
0	No Fault	No Fault Conditions Detected
1	Ground Fault	Power conductor or motor winding is shorting to ground
2	L1 Undercurrent	Line 1 current is lower than the programmed level
3	L2 Undercurrent	Line 2 current is lower than the programmed level
4	L3 Undercurrent	Line 3 current is lower than the programmed level
5	L1 Overcurrent	Line 1 current exceeds the programmed level
6	L2 Overcurrent	Line 2 current exceeds the programmed level
7	L3 Overcurrent	Line 3 current exceeds the programmed level
8	L1 Loss	Current in line 1 is not present
9	L2 Loss	Current in line 2 is not present
10	L3 Loss	Current in line 3 is not present
11	Comm Fault	DeviceNet communications fault detected
12	Comm Idle	DeviceNet idle condition detected
13	Config Fault	Parameter configuration fault. Check configuration parameters for the proper values.
14	PM - # Starts	Number of starts has exceeded the programmed level
15	PM- Oper. Hours	Number of operating hours has exceeded the programmed level

TripHistory Mask This parameter allows the user to configure which current based protection features are written to the five record Trip History as outlined in the table below: 1 = Recorded 0 = Not Recorded	Parameter Number	142
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	0Fhex-8E-01
	Group	TripWarn History
	Units	—
	Minimum Value	0000000000000000
	Maximum Value	1111111111111111
Default Value		1101111101111111

Bit																Function:
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
															X	Ground Fault
														X		L1 Undercurrent
													X			L2 Undercurrent
												X				L3 Undercurrent
										X						L1 Overcurrent
									X							L2 Overcurrent
								X								L3 Overcurrent
							X									L1 Loss
						X										L2 Loss
					X											L3 Loss
				X												Comm Fault
			X													Comm Idle
		X														Hardware Fault
	X															Test Trip
																Remote Trip
X																NonVol Mem Fault

WarnHistory Mask This parameter allows the user to configure which current based protection features are written to the five record Warning History as outlined in the table below: 1 = Recorded 0 = Not Recorded	Parameter Number	143
	Access Rule	Get/Set
	Data Type	UINT
	Object Mapping	0Fhex-8F-01
	Group	TripWarn History
	Units	—
	Minimum Value	0000000000000000
	Maximum Value	0111111111111111
	Default Value	0111111111111111

Bit																Function:
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
															X	Ground Fault
														X		L1 Undercurrent
													X			L2 Undercurrent
												X				L3 Undercurrent
											X					L1 Overcurrent
									X							L2 Overcurrent
								X								L3 Overcurrent
							X									L1 Loss
						X										L2 Loss
					X											L3 Loss
				X												Comm Fault
			X													Comm Idle
		X														Config Fault
	X															PM Starts
																PM Oper Hours
																Reserved

Trip Snapshot

The EC4 Current Monitoring Relay with firmware revision 5.01 and higher will record up to four real time data parameters in non-volatile memory in the event of an EC4 Current Monitoring Relay trip. This information can be used by maintenance personnel to understand the electrical conditions of the electric motor at the time of the trip.

Trip Snapshot Group

SS L1 Current This parameter reports the value of L1 Current at the time of the last relay trip.	Parameter Number	144
	Access Rule	Get
	Data Type	INT
	Object Mapping	0Fhex-90-01
	Group	Trip Snapshot
	Units	Amps
	Minimum Value	0
	Maximum Value	32767
	Default Value	—

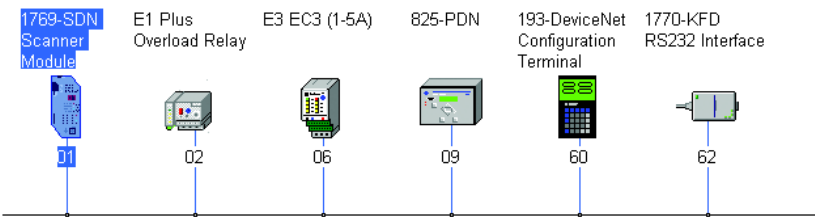
SS L2 Current This parameter reports the value of L2 Current at the time of the last relay trip.	Parameter Number	145
	Access Rule	Get
	Data Type	INT
	Object Mapping	0Fhex-91-01
	Group	Trip Snapshot
	Units	Amps
	Minimum Value	0
	Maximum Value	32767
	Default Value	—
SS L3 Current This parameter reports the value of L3 Current at the time of the last relay trip.	Parameter Number	146
	Access Rule	Get
	Data Type	INT
	Object Mapping	0Fhex-92-01
	Group	Trip Snapshot
	Units	Amps
	Minimum Value	0
	Maximum Value	32767
	Default Value	—
SS GF Current This parameter reports the value of ground fault current at the time of the last relay trip.	Parameter Number	148
	Access Rule	Get
	Data Type	INT
	Object Mapping	0Fhex-94-01
	Group	Trip Snapshot
	Units	Amps
	Minimum Value	0
	Maximum Value	1275
	Default Value	—

Logic Controller Application Example with Explicit Messaging

Introduction

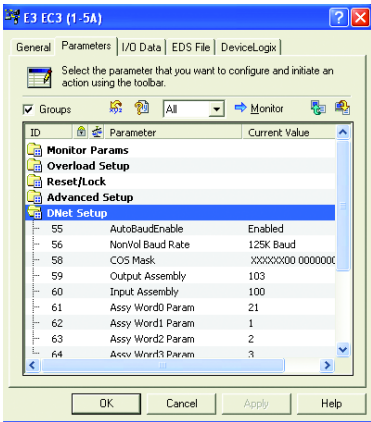
This example demonstrates discrete control of the EC4 Current Monitoring Relay's output relay and the use of the explicit messaging function for transferring parameter data to a CompactLogix L32E via a 1769-SDN DeviceNet scanner module named DNET. The selections shown are example-specific. Some changes by the user may be necessary to apply the concepts of this example to a specific application.

Figure 32 - Network Example

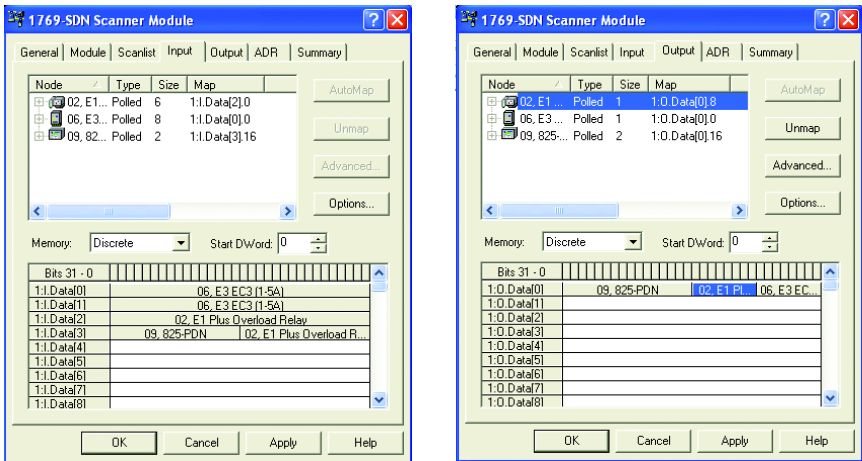


I/O Mapping

For this example, a CompactLogix L32E will energize OUT A on an EC4 Current Monitoring Relay using DeviceNet I/O Messaging. The EC4 is configured as Node 6 on the DeviceNet network. Its Output Assembly is configured to use Output Assembly 103, and its Input Assembly is configured to use Input Assembly 100 as shown:



The 1769-SDN was configured to scan I/O from various devices, including the EC4, and store this information to the following memory locations within the CompactLogix L32E as shown:



To have the CompactLogix controller energize OUT A of the EC4 Current Monitoring Relay using I/O Messaging, set Bit 0 in Word 1:O.Data[0] to a 1. OUT A should be energized.

Controller Tags - DeviceNet(controller)						
Scope: DeviceNet		Show...	Show All			
Name	Value	Force Mask	Style	Data Type		
+ Explicit_MSG_DeviceStatus_CIA	{...}	{...}		MESSAGE		
+ Explicit_MSG_DeviceStatus_Param	{...}	{...}		MESSAGE		
+ Explicit_MSG_TripClass_CIA	{...}	{...}		MESSAGE		
+ Integer_Files	{...}	{...}	Decimal	DINT[20]		
+ Local:1:I	{...}	{...}		AB:1769_SDN_4...		
+ Local:1:O.CommandRegister	{...}	{...}		AB:1769_SDN_C...		
- Local:1:O.Data	{...}	{...}	Decimal	DINT[90]		
- Local:1:O.Data[0]	1		Decimal	DINT		
- Local:1:O.Data[0]0	1		Decimal	BOOL		
- Local:1:O.Data[0]1	0		Decimal	BOOL		
- Local:1:O.Data[0]2	0		Decimal	BOOL		
- Local:1:O.Data[0]3	0		Decimal	BOOL		

To verify that OUT A of the EC4 Current Monitoring Relay was energized, the CompactLogix controller will read the device status of the EC4 Current Monitoring Relay and place that information at Word 1:I.Data[0] with the L32E. Bit 2 identifies the state of OUT A.

Controller Tags - DeviceNet(controller)						
Scope: DeviceNet		Shgw...	Show All			
Name	Value	Force Mask	Style	Data Type		
Explicit_MSG_DeviceStatus_CIA	{...}	{...}		MESSAGE		
Explicit_MSG_DeviceStatus_Param	{...}	{...}		MESSAGE		
Explicit_MSG_TripClass_CIA	{...}	{...}		MESSAGE		
Integer_Files	{...}	{...}	Decimal	DINT[20]		
Local:1:I	{...}	{...}		AB:1769_SDN_4...		
Local:1:I.Fault	2#0000_000...		Binary	DINT		
Local:1:I.Status	{...}	{...}		AB:1769_SDN_St...		
Local:1:I.StatusRegister	{...}	{...}		AB:1769_SDN_St...		
Local:1:I.Data	{...}	{...}	Decimal	DINT[90]		
Local:1:I.Data[0]	16#0000_0004		Hex	DINT		
Local:1:I.Data[0].0	0		Decimal	BOOL		
Local:1:I.Data[0].1	0		Decimal	BOOL		
Local:1:I.Data[0].2	1		Decimal	BOOL		
Local:1:I.Data[0].3	0		Decimal	BOOL		
Local:1:I.Data[0].4	0		Decimal	BOOL		
Local:1:I.Data[0].5	0		Decimal	BOOL		
Local:1:I.Data[0].6	0		Decimal	BOOL		

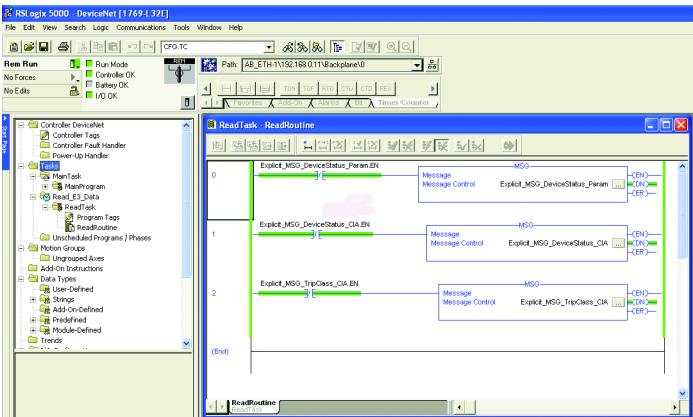
For more information on configuring the scanlist of a DeviceNet Scanner, refer to DeviceNet Node Commissioning on page 4-48.

Explicit Messaging

The EC4 Current Monitoring Relay supports Explicit Messaging via DeviceNet. This allows a controller to read and write various parameters from an EC4 Current Monitoring Relay. In this example, a CompactLogix L32E controller will read three parameters from the EC4 located on Node 6 on a DeviceNet via Explicit Messaging using various Object Classes and storing the information in an array of Integer_Files.

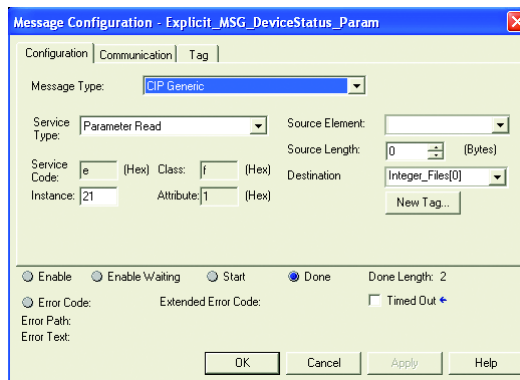
Reading Device Status using the Parameter Object Class (0x0F)

In this example a Periodic Task has been configured within the L32E to execute every 1000 msec in which a message instruction will be used to read the Device Status of the EC4 Current Monitoring Relay using the Parameter Object Class. The supporting ladder logic was added to execute a MSG instruction every time this Periodic Task executes.



The Device Status is located in Parameter 21 within the EC4 Current Monitoring Relay. Setup the MSG instruction in the Configuration tab to read Parameter 21 using the Parameter Object Class by configuring the following fields:

- Message Type: CIP Generic
- Service Type: Parameter Read
- Service Code: 0x0E (hex)
- Class: 0x0F (hex)
- Instance: 21 (dec)
- Attribute: 0x01 (hex)
- Destination: Integer_Files[0]

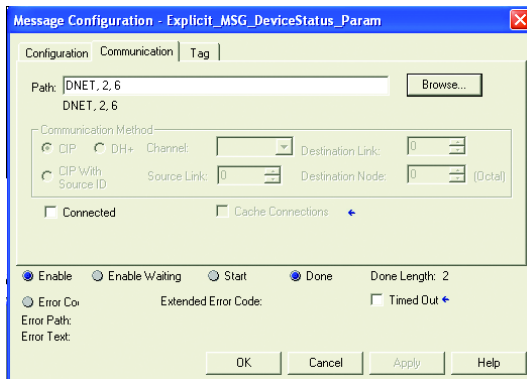


Next, set up the communications path in the Communication tab to read data from the EC4 Current Monitoring Relay located at Node 6 by configuring the communication Path as “**DNET, 2, 6**”

DNET - the name of the 1769-SDN DeviceNet Scanner

2 – The port number of the 1769-SDN DeviceNet Scanner

6 – The node address of the EC4 Current Monitoring Relay



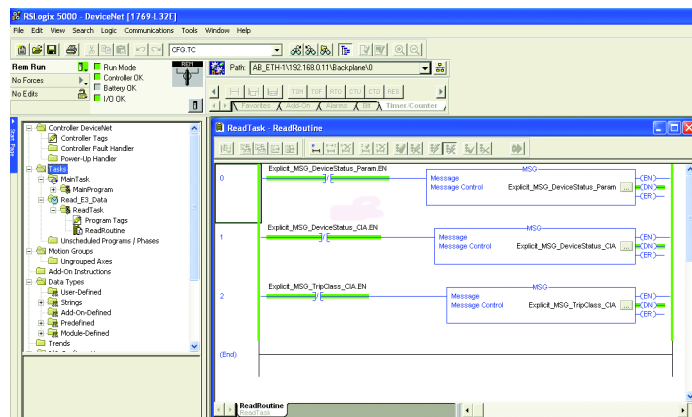
When finished, the MSG instruction will read the Device Status from the EC4 Current Monitoring Relay and place the results in Integer_Files[0] as shown:

Name	Value	Force Mask	Style	Data Type
Explicit_MSG_DeviceStatus_CIA	{...}	{...}		MESSAGE
Explicit_MSG_DeviceStatus_Param	{...}	{...}		MESSAGE
Explicit_MSG_TripClass_CIA	{...}	{...}		MESSAGE
Integer_Files	{...}	{...}		Decimal DINT[20]
Integer_Files[0]	4			Decimal DINT
Integer_Files[0] 0	0			Decimal BOOL
Integer_Files[0] 1	0			Decimal BOOL
Integer_Files[0] 2	1			Decimal BOOL
Integer_Files[0] 3	0			Decimal BOOL
Integer_Files[0] 4	0			Decimal BOOL
Integer_Files[0] 5	0			Decimal BOOL
Integer_Files[0] 6	0			Decimal BOOL
Integer_Files[0] 7	0			Decimal BOOL
Integer_Files[0] 8	0			Decimal BOOL
Integer_Files[0] 9	0			Decimal BOOL

Currently OUT A of the EC4 Current Monitoring Relay is energized as shown in Bit 2 in Integer_Files[0].

Reading Device Status using the Control Supervisor Object Class (0x29)

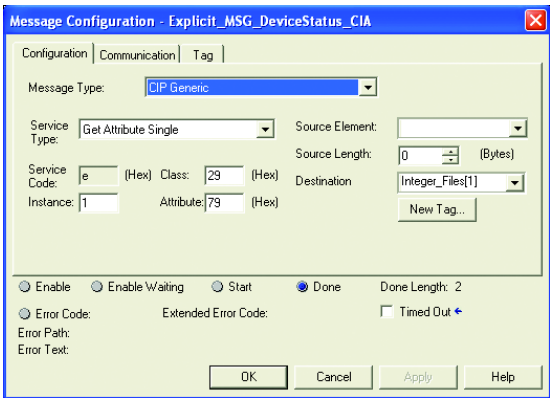
In this example, a Periodic Task has been configured within the L32E to execute every 1000 msec in which a message instruction will be used to read the Device Status of the EC4 Current Monitoring Relay using the Control Supervisor Object Class. The supporting ladder logic was added to execute a MSG instruction every time this Periodic Task executes.



The Device Status is located in Parameter 21 within the EC4 Current Monitoring Relay. Set up the MSG instruction in the Configuration tab to read Parameter 21 using the Parameter Object Class by configuring the following fields:

- Message Type: CIP Generic
- Service Type: Get Attribute Single
- Service Code: 0x0E (hex)
- Class: 0x29 (hex)
- Instance: 0x01 (hex)
- Attribute: 0x79 (hex)

– Destination: Integer_Files[1]

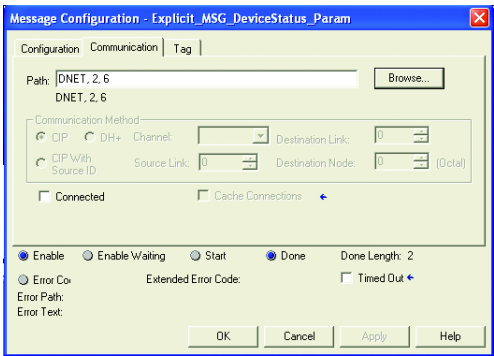


Next, set up the communications path in the Communication tab to read data from the EC4 Current Monitoring Relay located at Node 6 by configuring the communication Path as “DNET, 2, 6”

DNET - the name of the 1769-SDN DeviceNet Scanner

2 – The port number of the 1769-SDN DeviceNet Scanner

6 – The node address of the EC4 Current Monitoring Relay



When finished, the MSG instruction will read the Device Status from the EC4 Current Monitoring Relay and place the results in Integer_Files[1] as shown:

Controller Tags - DeviceNet(controller)				
Scope:	DeviceNet	Show...	Show All	
Name	Value	Force Mask	Style	Data Type
Explicit_MSG_DeviceStatus_CIA	(...)	(...)		MESSAGE
Explicit_MSG_DeviceStatus_Param	(...)	(...)		MESSAGE
Explicit_MSG_TripClass_CIA	(...)	(...)		MESSAGE
Integer_Files	(...)	(...)		Decimal DINT[20]
Integer_Files[0]	4		Decimal	DINT
Integer_Files[1]	4		Decimal	DINT
Integer_Files[1]0	0		Decimal	BOOL
Integer_Files[1]1	0		Decimal	BOOL
Integer_Files[1]2	1		Decimal	BOOL
Integer_Files[1]3	0		Decimal	BOOL
Integer_Files[1]4	0		Decimal	BOOL
Integer_Files[1]5	0		Decimal	BOOL
Integer_Files[1]6	0		Decimal	BOOL
Integer_Files[1]7	0		Decimal	BOOL
Integer_Files[1]8	0		Decimal	BOOL
Integer_Files[1]9	0		Decimal	BOOL

Currently OUT A of the EC4 Current Monitoring Relay is energized as shown in Bit 2 in Integer_Files[1].

Reading a Group of Parameters using the Status Object Class (0x0375)

In this example, a Periodic Task has been configured within the L32E to execute every 1000 ms. In this task, one message instruction will be used to read 25 parameters that include data from the voltage, current, real power, reactive power, apparent power, and power factor groups using the Status Object Class (included in firmware revision number 5.01 and higher). The supporting ladder logic was added to execute a MSG instruction every time this Periodic Task executes.

The Status Object allows a user to define which groups of parameters to read from a single message instruction. Set up an array of integers to define the list of attributes (parameter groups) to read back from an overload relay with firmware revision 5.01 and higher. The list of attributes for the status object is shown in Appendix B.

The data will return in an integer array with the first integer representing the following information:

- Number of Attributes
- First Attribute Number Being Returned
- First Attribute Number Data Status
- First Attribute Data
- Last Attribute Number Being Returned
- Last Attribute Number Data Status
- Last Attribute Data

Set up the MSG instruction in the Configuration tab to read the list of attributes (Parameter Groups) by configuring the following fields:

- Message Type: CIP Generic
- Service Type: Custom
- Service Code: 0x03 (hex)
- Class: 0x375 (hex)
- Instance: 1 (dec)
- Attribute: 0x00 (hex)
- Source Element: MSG_Read_Request[0]
- Source Length: Size of source data (Bytes)
- Destination: MSG_Read_Data

The screenshot shows the 'Message Configuration - MSG_Read_Message' dialog box with the 'Configuration' tab selected. The 'Message Type' is set to 'CIP Generic'. The 'Service Type' is 'Custom'. The 'Source Element' is 'MSG_Read_Request' and the 'Source Length' is 14 bytes. The 'Service Code' is 3 (Hex), 'Class' is 375 (Hex), and 'Destination' is 'MSG_Read_Data'. The 'Instance' is 1 and 'Attribute' is 0 (Hex). There is a 'New Tag...' button. At the bottom, there are radio buttons for 'Enable', 'Enable Waiting', 'Start', and 'Done' (which is selected). There are also fields for 'Error Code', 'Extended Error Code', and a 'Timed Out' checkbox. The 'Done Length' is 76. Buttons for 'OK', 'Cancel', 'Apply', and 'Help' are at the bottom right.

Next, set up the communications path in the Communication tab to read data from the EC4 Current Monitoring Relay located at Node 6 by configuring the communication Path as “DNET, 2, 6”.

DNET - the name of the 1769-SDN DeviceNet Scanner

2 – The port number of the 1769-SDN DeviceNet Scanner

6 – The node address of the EC4 Current Monitoring Relay

The screenshot shows the 'Message Configuration - MSG_Read_Message' dialog box with the 'Communication' tab selected. The 'Path' is set to 'DNET, 2, 6'. There is a 'Browse...' button. The 'Communication Method' section has radio buttons for 'CIP' (selected) and 'CIP With Source ID'. The 'Channel' is set to 0. The 'Destination Link' is 0. The 'Source Link' is 0. The 'Destination Node' is 0 (Octal). There are checkboxes for 'Connected' and 'Cache Connections' (which is checked). At the bottom, there are radio buttons for 'Enable', 'Enable Waiting', 'Start', and 'Done' (which is selected). There are also fields for 'Error Code', 'Extended Error Code', and a 'Timed Out' checkbox. The 'Done Length' is 76. Buttons for 'OK', 'Cancel', 'Apply', and 'Help' are at the bottom right.

When finished, the MSG instruction will read the 25 parameters from the EC4 Current Monitoring Relay and place the results into MSG_Read_Data.

Using DeviceLogix™

Introduction

DeviceLogix is a stand-alone Boolean program which resides within the EC4 Current Monitoring Relay. RSNetworx for DeviceNet is required to program the device; however, since the program is embedded in the EC4 software, no additional module is required to use this technology. It is important to note that the DeviceLogix program will only run if the logic has been enabled, which can be done within the Logic Editor of RSNetWorx for DeviceNet or the DeviceNet Configuration Terminal (Cat. No. 193-DNCT).

In addition to executing specific Boolean logic, DeviceLogix can also be used to provide specific output performance under specific communication or network conditions. This can be accomplished by properly configuring *Comm Override* and *Network Override* parameters.

Comm Override. The configuration of the *Comm Override* parameter defines whether or not DeviceLogix controls the EC4 outputs when either a Comm Fault (lack of I/O connection) or Comm Idle (Master not in Run mode) condition exists. If DeviceLogix is enabled but *Comm Override* is disabled (default), the operation of the EC4 outputs will be controlled by the DeviceNet Fault State, Fault Value, Idle State, and Idle Value parameters if a Comm Fault or Comm Idle condition occurs. If DeviceLogix and *Comm Override* are both enabled, the EC4 outputs are controlled by the DeviceLogix program, regardless of the Comm Fault or Comm Idle state. If DeviceLogix is not enabled, the outputs will be controlled by the DeviceNet Fault/Idle State/Value parameters if a Comm Fault or Comm Idle condition occurs – regardless of the *Comm Override* configuration. If DeviceLogix is transitioned from enable to disable, the outputs will immediately go to the programmed DeviceNet Idle State/Value.

Network Override. The configuration of the *Network Override* parameter defines whether or not DeviceLogix controls the EC4 outputs when a network fault, such as a duplicate Mac ID or bus off condition, exists. If DeviceLogix is enabled but *Network Override* is disabled (default), the operation of the EC4 outputs will be controlled by the DeviceNet Fault State and Fault Value parameters if a network fault occurs. If DeviceLogix and *Network Override* are both enabled, the EC4 outputs are controlled by the DeviceLogix program, regardless of the network status. If DeviceLogix is not enabled, the outputs will be controlled by the DeviceNet Fault/Idle State/Value parameters if a Comm Fault condition occurs – regardless of the *Network Override* configuration. If DeviceLogix is transitioned from enable to disable, the outputs will immediately go to the programmed DeviceNet Idle State/Value.

DeviceLogix Programming

DeviceLogix has many applications and the implementation is typically only limited to the imagination of the programmer. Keep in mind that the application of DeviceLogix is only designed to handle simple logic routines.

DeviceLogix is programmed using simple Boolean math operators, such as AND, OR, NOT, timers, counters, and latches. Decision making is made by combining these Boolean operations with any of the available I/O. The inputs and outputs used to interface with the logic can come from the network or from the device hardware. Hardware I/O is the physical Inputs and Outputs located on the device such as push buttons and pilot lights that are connected to the EC4 Current Monitoring Relay. There are many reasons to use the DeviceLogix functionality, but some of the most common are listed below:

- Increased system reliability
- Improved diagnostics and reduced troubleshooting
- Operation independent of PLC or Network status
- Continue to run process in the event of network interruptions
- Critical operations can be safely shutdown through local logic

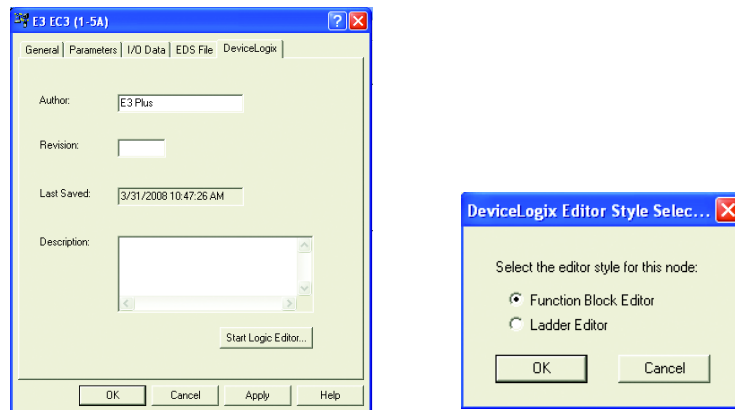
DeviceLogix can be programmed using function blocks or ladder logic through RS Network for DeviceNet. After a successful download to the EC4 Current Monitoring Relay, DeviceLogix can be enabled using RS Network for DeviceNet or the DeviceNet configuration terminal (Cat. No. 193-DNCT).

DeviceLogix Programming Example

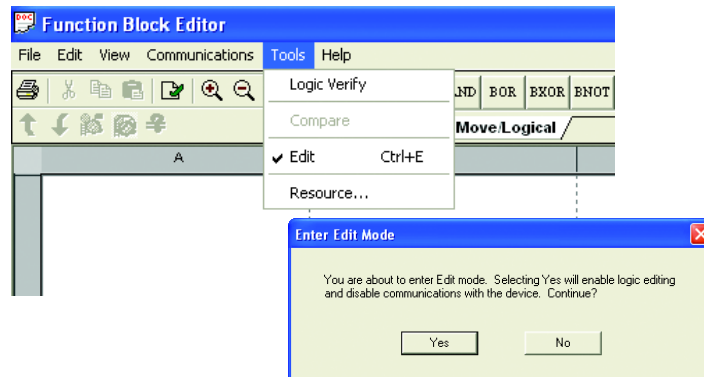
The following example shows how to program a simple logic routine to control the EC4 Current Monitoring Relay's outputs based on the condition of input signals. OUT A control is defined by the states of IN1 and IN2 processed through a Boolean OR gate. OUT B control is defined by the states of IN3 and IN4 processed through a separate Boolean OR gate. This example is using RSNetwork for DeviceNet version 8.00.01 and an EC4 current monitoring relay.

IMPORTANT Before programming logic it is important to decide on the conditions under which the logic run. As defined earlier, the conditions can be defined by setting parameter 79 (Comm Override) and parameter 80 (Network Override) to the value that you want.

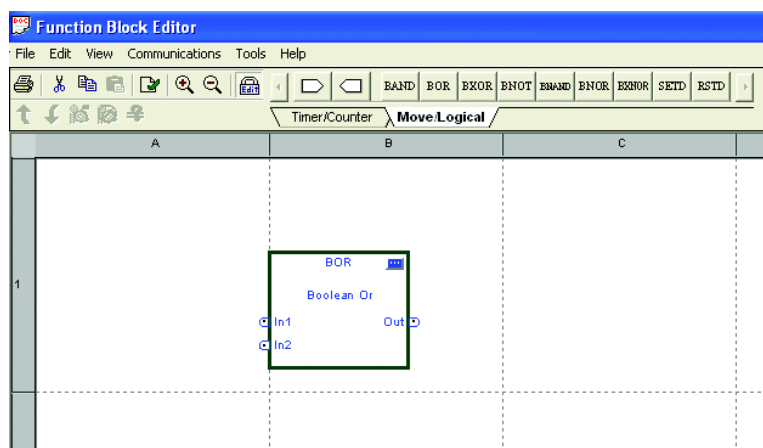
1. While in RSNetWorks for DeviceNet, double-click on the EC4 and select the DeviceLogix Tab. If you are prompted with a dialog box while online with the EC4, then select Upload. Next, select Start Logic Editor, select the Function Block Editor, and press OK.



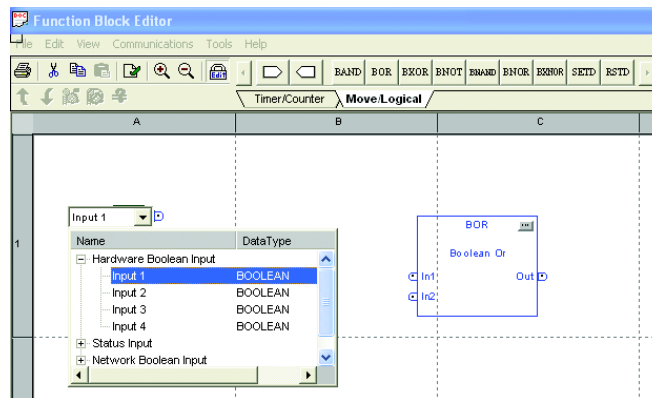
2. If programming offline, then continue to Step 3. If programming online, place the EC4 into Edit mode by selecting Edit from the Tools pull down menu or by selecting the  button. Select **Yes** to enter Edit mode.



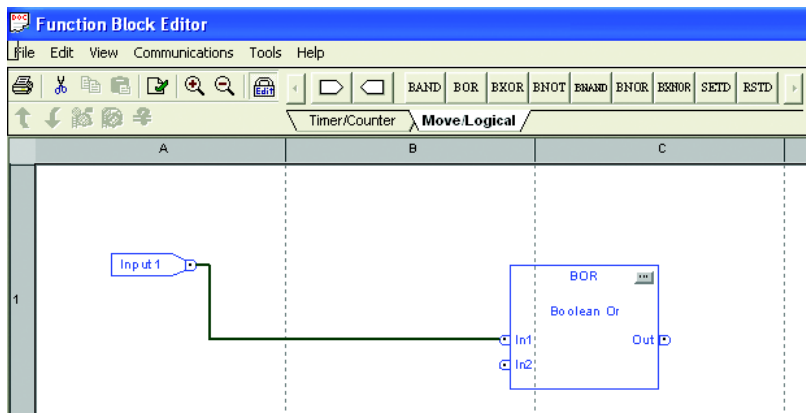
3. Using the left mouse button, select the Boolean OR (BOR) function block  from the Move/Logical tab and drag it onto the display.



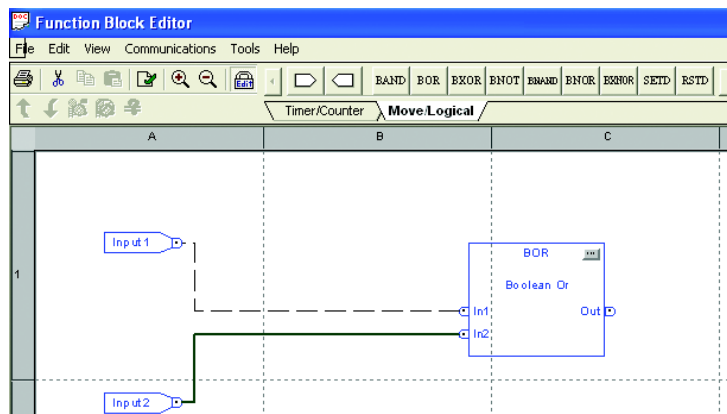
4. Using the left mouse button, select the Bit Input block  and drag it to the left of the BOR function block. Double-click on the Bit Input block to select Input 1 of the EC4 under the Hardware Boolean Input set.



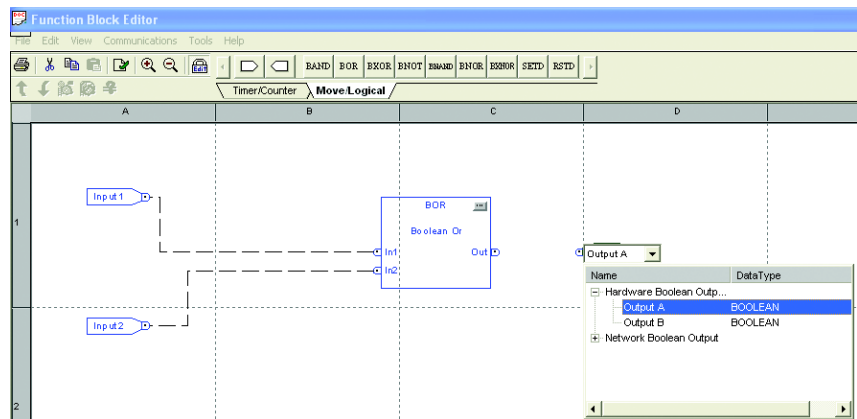
5. Place the cursor on the right of the Bit Input block and press the left mouse button. Draw a line from the Bit Input block to the In1 of the BOR function block and double-click the left mouse button to establish a connection.



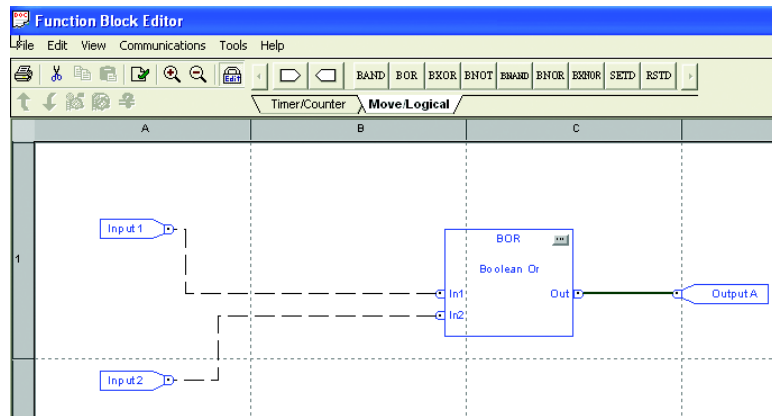
6. Repeat steps 4 and 5 to add Input 2 of the EC4 to In2 of the BOR function block.



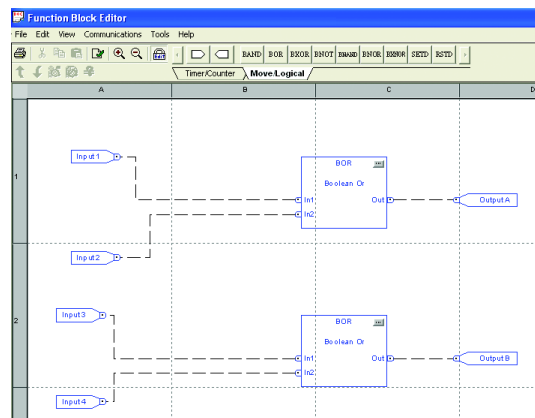
7. Using the left mouse button, select the Bit Output block  and drag it to the right of the BOR function block. Double-click on the Bit Input block to select Output A of the EC4 under the Hardware Boolean Output set.



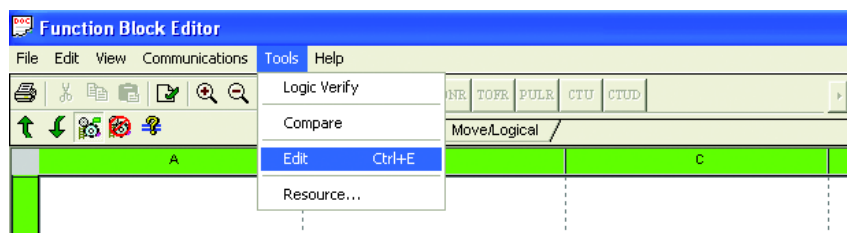
8. Place the cursor on the left of the Bit Output block and press the left mouse button. Draw a line from the Bit Output block to the Out of the BOR function block and double-click the left mouse button to establish a connection.



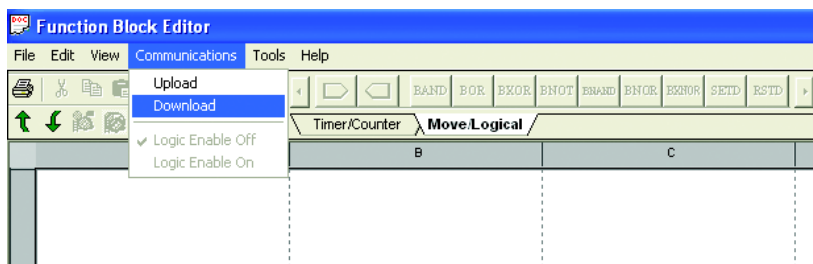
9. Repeat steps 3 through 8 to add a second BOR function block that monitors Input 3 and 4 to control Output B of the EC4.



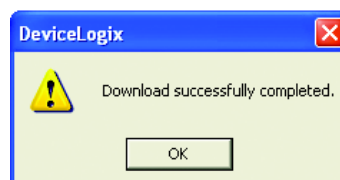
10. Disable Edit mode by de-selecting the Edit mode button  or through the Tools menu.



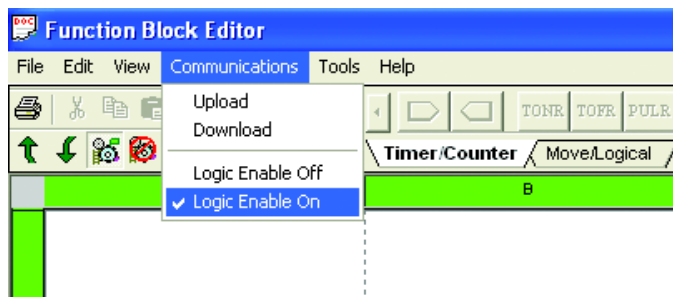
11. If programming the function block offline, exit the Function Block editor and go online with the DeviceNetwork. Download the parameters, including the DeviceLogix Function Blocks, to the EC4 and proceed to step 12. If programming the function block online, download the Function Blocks to the EC4 by selecting the Download button  or through the Communications menu.



A dialog box will appear when the Function Blocks are successfully downloaded to the EC4. Press OK to continue.



12. Next, the DeviceLogix Function Blocks need to be enabled. This can be done through a DeviceNet Configuration Terminal (Catalog Number 193-DNCT) or through RSNetWorx. When using RSNetWorx to enable the DeviceLogix function blocks, select the Logic Enable On button  or through the Communications menu.



13. Verify the functionality of the DeviceLogix Function Blocks by enabling Input 1 on the EC4. When Input 1 is enabled, Output A will energize.

Troubleshooting

Introduction

The purpose of this chapter is to assist in troubleshooting the EC4 Current Monitoring Relay using its advisory LEDs and diagnostic parameters.



ATTENTION: Servicing energized industrial control equipment can be hazardous. Electrical shock, burns, or unintentional actuation of controlled industrial equipment may cause death or serious injury. For safety of maintenance personnel as well as others who may be exposed to electrical hazards associated with the maintenance activities, follow the local safety-related work practices (for example, the NFPA 70E, Part II, *Electrical Safety for Employee Workplaces*, in the United States) when working on or near energized equipment. Maintenance personnel must be trained in the safety practices, procedures, and requirements that pertain to their respective job assignments. Do not work alone on energized equipment.



ATTENTION: Do not attempt to defeat or override fault circuits. The cause of a fault indication must be determined and corrected before attempting operation. Failure to correct a control system or mechanical malfunction may result in personal injury and/or equipment damage due to uncontrolled machine system operation.

Advisory LEDs

The EC4 Current Monitoring Relay provides the following advisory LED indicators:

☐ NETWORK STATUS	☐ TRIP / WARN
☐ OUT A	☐ OUT B
☐ IN 1	☐ IN 3
☐ IN 2	☐ IN 4

Trip/Warn LED

This Trip/Warn LED will indicate device status by flashing a red trip code or an amber warning code. The number of flashes followed by a pause identifies the specific trip or warning. Refer to the product's side label or the chart below for trip and warning codes. Refer to the *Trip/Warn LED Troubleshooting Procedures*

section of this chapter for tips associated with troubleshooting trip and warning conditions. A listing of these codes can be found on the side of the EC4 Current Monitoring Relay in addition to the table below.

Table 23 - Trip/Warn Codes

Trip Description	Trip Code (Red)	Warning Code (Amber)	Protection Fault	Non-Volatile Fault
Ground Fault	1	1	Yes	Yes
L1 Undercurrent	2	2	Yes	Yes
L2 Undercurrent	3	3	Yes	Yes
L3 Undercurrent	4	4	Yes	Yes
L1 Overcurrent	5	5	Yes	Yes
L2 Overcurrent	6	6	Yes	Yes
L3 Overcurrent	7	7	Yes	Yes
L1 Loss	8	8	Yes	Yes
L2 Loss	9	9	Yes	Yes
L3 Loss	10	10	Yes	Yes
Comm Fault	11	11	Yes	No
Comm Idle	12	12	No	No
Hardware Fault (trip) Configuration Fault (warning)	13	13	No	No
Test Trip (trip) PM - # Starts (warning)	14	14	No	No
Remote Trip (trip) PM – Oper. Hours (warning)	15	15	No	No
NonVol Mem Fault	16	—	No	No

IMPORTANT The Trip conditions identified as “Protection Faults” are the basis for the OUTA Pr FltState, OUTA Pr FltValue, OUTB Pr FltState, and OUTB Pr FltValue parameters.

IMPORTANT Cycling power to the EC4 Current Monitoring Relay will not clear a “Non-Volatile Fault”. A “Non-Volatile Fault” must be manually reset. An Overload or PTC Fault can also be automatically reset.

Network Status LED

This LED provides information on the state of the EC4 Current Monitoring Relay’s DeviceNet network connection. Refer to the *DeviceNet Troubleshooting Procedure* section for descriptions of the various states this LED can take and the associated recommended corrective action.

OUT A & OUT B LEDs

The amber OUT A or OUT B LED illuminates when the output is commanded on. However, an illuminated LED does not guarantee that the output is actually on.

IN 1,2,3 & 4 LEDs

The amber IN1, IN2, IN3, or IN4 LED illuminates when a user-connected contact is closed.

Power-Up Sequence

After the EC4 Current Monitoring Relay is installed according to the guidelines specified in Chapter 2, apply power to the current monitoring relay's DeviceNet connector. After applying power, the following sequence should occur:

1. The Trip relay should close 2.35 seconds later and the TRIP/WARN LED will not flash (unless a "Non-Volatile Fault" previously existed or a fault condition is present).
2. At the same time, the NETWORK STATUS LED should flash green for approximately 2 seconds, then red for 1/4 second. If autobaud is enabled and the EC4 Current Monitoring Relay is connected to an active network, the green LED will continue to flash once the baud rate has been determined. If the EC4 Current Monitoring Relay is not connected to an active network, this LED will not continue to flash.
3. Once the EC4 Current Monitoring Relay has been allocated by a Master, the NETWORK STATUS LED will turn solid green.

DeviceNet Modes of Operation

The EC4 Current Monitoring Relay has four DeviceNet modes of operation: Power-up Reset Mode, Run Mode, Recoverable Error Mode, and Unrecoverable Error Mode.

Power-Up Reset Mode

During Power-Up Reset Mode, the following occurs:

1. The NETWORK STATUS LED should flash green for approximately 2 seconds, then red for 1/4 second. If autobaud is enabled and the EC4 Current Monitoring Relay is connected to an active network, the green LED will continue to flash once the baud rate has been determined. If the EC4 Current Monitoring Relay is not connected to an active network, this LED will not continue to flash.

IMPORTANT The EC4 Current Monitoring Relay protection functions are still operational even without an established network connection.

2. Once the baud rate is determined, the EC4 Current Monitoring Relay performs a duplicate node address check to verify another node is not assigned to the same DeviceNet node address (MAC ID). If a duplicate node is detected on the network, the *NETWORK STATUS* LED turns solid red, and the EC4 Current Monitoring Relay enters the *Recoverable Error Mode*.

If the power-up or reset is successful, the current monitoring relay will enter *Run Mode*.

Run Mode

In Run Mode, the EC4 Current Monitoring Relay will operate as a slave device to a master device. The *NETWORK STATUS* LED will blink green if there are no network connections established with a network master. When one or more connections are in the “established” state, the *NETWORK STATUS* LED will turn solid green. When one or more connections are in the “timed-out” state, the *NETWORK STATUS* LED will blink red. In the Run Mode, the EC4 Current Monitoring Relay will:

1. Accept messages from a master on the DeviceNet network
2. Send response messages, COS messages, or CYCLIC messages to a master.

If a communication error is detected, the EC4 Current Monitoring Relay will either enter the *Recoverable Error* or *Unrecoverable Error Mode*.

Recoverable Error Mode

In Recoverable Error Mode, the EC4 Current Monitoring Relay's *NETWORK STATUS* LED turns solid red. The current monitoring relays will respond to messages that are specified in offline node recovery message protocol.

Error Type	Description	LED State
Recoverable	Duplicate node address detected	Solid Red

Unrecoverable Error Mode

In Unrecoverable Error Mode, the EC4 Current Monitoring Relay's *NETWORK STATUS* LED turns solid red. The current monitoring relay continues in this state as long as the device is powered.

Error Type	Description	LED State
Unrecoverable	Power-up initialization failure	Solid Red
	Incorrect baud rate	
	Fatal communication error (bus-off)	

Resetting a Trip



ATTENTION: Resetting a trip will not correct the cause for the trip. Corrective action should be taken before resetting the trip.

An EC4 Current Monitoring Relay trip condition can be reset by taking one of the following actions:

1. Actuating the TRIP/RESET button on the EC4 Current Monitoring Relay.
2. Setting the Fault Reset bit in the EC4 Current Monitoring Relay's Output Assembly via the DeviceNet network.
3. Actuating a reset signal
 - a. Actuating a reset signal to IN1 when Parameter 77, *IN1=Trip Reset*, is enabled (Series A, FRN 2.xxx).
 - b. Actuating a reset signal to one of the inputs when programmed to "Trip Reset" via one of the corresponding assignment parameters (83...86)
4. Cycling supply power to the EC4 Current Monitoring Relay to clear Non-Volatile Faults.
5. Setting Parameter 26, *Trip Reset*, to a value of 1 = trip reset.

Trip/Warn LED Troubleshooting Procedures

The following table lists the possible causes for each trip type and the recommended action to take.

Table 24 - Trip/Warn LED Troubleshooting Procedures

Trip Description	Possible Cause	Corrective Action
Test Trip	1. Operation of the Test/Reset button	1. Operate the Test/Reset button to clear the trip.
Undercurrent	1. Load under powered 2. Improper parameter settings	1. Check and correct source of overload (load, mechanical transmission components, motor bearings). 2. Set parameter values to match the motor and application requirements.
Overcurrent	1. Load over powered 2. Improper parameter settings	1. Check and correct source of overload (load, mechanical transmission components, motor bearings). 2. Set parameter values to match the motor and application requirements.
Ground Fault	1. Power conductor or motor winding is shorting to ground 2. Motor winding insulation is decayed 3. Foreign Object short 4. External ground fault sensor (core balance current transformer) has improper connection	1. Check power conductors and motor windings for low resistance to ground. 2. Check motor winding insulation for low resistance to ground. 3. Check for foreign objects. 4. Check cable connections.
Comm Fault	1. Communication disruption	1. Check the DeviceNet cabling for a wiring disconnection.
Comm Idle	1. Programmable controller processor set to the "program" mode.	1. Reset trip after the programmable controller process is returned to the "run" mode.
NonVol Memory Fault	1. Internal product failure	1. Consult the factory.
Hardware Fault (trip)	1. Hardware configuration failure	1. Verify that the input terminals (1,2,3,4,5 or 6) are not shorted at the PTC terminals (IT1, IT2). 2. Consult the factory.

Table 24 - Trip/Warn LED Troubleshooting Procedures

Configuration Fault (warning)	1. Parameter 27, <i>Single/Three Ph</i>, is set to single phase and current is being sensed in phase L3 during motor operation. 2. FLA setting is outside the “legal” range, as determined by the corresponding CT Ratio setting.	1. For three-phase applications, Parameter 27, <i>Single/Three Ph</i>, should be set to “three-phase”. 2. See Table 20 - and program the FLA setting within the range specified.
Remote Trip	1. Contact closure of remote sensor (e.g., vibration switch).	1. Take corrective action to address the issue that caused the sensor to actuate. 2. Check sensor for proper operation. 3. Check wiring.
PM - # Starts (warning)	1. Parameter 96, <i>Starts Counter</i>, is equal to or greater than the value set in parameter 101, <i>PM - # Starts</i>.	1. Set parameter 104, <i>Clear Queue</i>, to reset parameter 96, <i>Starts Counter</i>.
PM – Oper. Hours (warning)	1. Parameter 95, <i>Elapsed Time</i>, is equal to or greater than the value set in parameter 102, <i>PM – Oper. Hours</i>.	1. Set parameter 104, <i>Clear Queue</i>, to reset parameter 95, <i>Elapsed Time</i>.

DeviceNet Troubleshooting Procedures

The following table identifies possible causes and corrective actions when troubleshooting DeviceNet related failures using the *NETWORK STATUS* LED.

Table 25 - DeviceNet Troubleshooting Procedures

Color	State	Possible Cause	Corrective Action
None		1. The EC4 Current Monitoring Relay is not receiving power at the DeviceNet connector.	1. Check DeviceNet power and cable connections and the power connection on the DeviceNet connector.
Green Red Off	Flashing	1. The E3 or EC4 Current Monitoring Relay is trying to determine the network baud rate	1. The current monitoring relay can not determine the network baud rate if no network traffic exists. Network traffic can be induced by invoking a Network Who using DeviceNet Manager.
Green	Flashing	1. Current Monitoring Relay is on-line but not allocated to a master.	1. Check DeviceNet master and its scan list for correct scanner configuration.
Green	Solid	1. Normal operating state, and the EC4 Current Monitoring Relay is allocated to a master.	1. No action required.
Red	Flashing	1. I/O connection timed-out	1. Reset DeviceNet master device.
Red	Solid	1. Diagnostics test failed on power-up/reset. Internal fault exists. 2. Duplicate DeviceNet node address exists (two DeviceNet nodes cannot have the same address). 3. Invalid baud rate (if autobaud is disabled).	1. Cycle power to the unit and network. If the fault still exists, replace unit. 2. Change the value of Parameter 57, <i>NonVol MAC ID</i>, to a valid address and reset the device. 3. This will only occur if Parameter 55, <i>AutoBaudEnable</i>, is set to “disabled”. Set Parameter 55 to “enabled” and reset the EC4 Current Monitoring Relay (or) set Parameter 56, <i>NonVol Baud Rate</i>, to the correct setting and reset the EC4 Current Monitoring Relay.

Loss of Node Address

Please refer to DeviceNet Node Commissioning on page 4-48 for further information regarding node commissioning.

Input and Output Troubleshooting Procedures



ATTENTION: If the outputs are to be commanded via an explicit message, ensure that there can never be an established I/O connection that can actively control them, and that the explicit message connection has a non-zero expected packet rate (EPR) setting.

Table 26 - Input and Output Troubleshooting Procedures

Failure Type	Failure Description	Corrective Action
Input 1...4	Input 1,2,3 or 4 does not appear to recognize a contact closure	1. Check the supply voltage on the DeviceNet connector. 2. If the applicable contact closes but the EC4 Current Monitoring Relay Input does not recognize the closure, check the continuity and wiring to the connected contact. 3. Check the IN 1,2,3 and 4 status LEDs. If the appropriate LED does not illuminate, measure the voltage across and current through the applicable input. Verify they are within the ratings of the EC4 Current Monitoring Relay (See Appendix A). 4. If the appropriate Input LED does illuminate, but the input status is not reported properly over the DeviceNet network, check the programmable controller ladder logic and I/O mapping.
Input 1	Trip reset operation	1. Check the programming of Parameter 77, <i>IN1=Trip Reset</i> ❶
Trip Relay	The trip relay does not appear to be functioning properly	1. Check the <i>TRIP/WARN</i> and <i>NETWORK STATUS</i> LEDs, or the <i>DEVICE STATUS</i> and <i>TRIP STATUS</i> parameters. If a Protection Fault exists, refer to the <i>Trip and Warning</i> troubleshooting procedure. If a DeviceNet-related fault exists, refer to the <i>DeviceNet</i> troubleshooting procedure. 2. Press the Test/Reset button on the EC4 Current Monitoring Relay. The trip relay should open and the TRIP/WARN LED should exhibit a single red flash code. Remove the control circuit power and measure the impedance across terminals 95 and 96 to verify the trip relay contacts are open. Press the Test/Reset button again. The unit should reset and the trip relay contacts should close. Measure across terminals 95 and 96 to ensure the trip relay contacts closed. 3. Remove control circuit supply power and check the control wiring to the EC4 Current Monitoring Relay Trip Relay (95/96). Note: The E3 Trip Relay contacts will not close until 2.35 seconds after power is applied to the EC4 Current Monitoring Relay DeviceNet connector. If a "Non-Volatile Fault" previously existed or a fault condition is present during power-up, the trip relay contacts will not close until the fault condition is removed and the trip is reset.
OUT A or OUT B	Output A or Output B does not appear to turn on (close) when commanded to do so	1. Check the supply voltage on the DeviceNet connector. 2. Check the OUTA and OUTB status LEDs. If the appropriate LED does not illuminate, check the programmable controller ladder logic and I/O mapping. 3. If the appropriate Output LED is illuminated, remove the control circuit power and check for continuity across the appropriate output terminals (13/14 for OUTA, 23/24 for OUTB). If the continuity test indicates the output is open, replace the EC4 Current Monitoring Relay. Check the supply voltage against the ratings of the contactor and the relay output before installing a new unit. 4. Remove control circuit power and check the control circuit fuse and the control wiring to the EC4 Current Monitoring Relay output terminals. 5. Check the control circuit power supply. Verify the voltage is within the contactor and current monitoring relay ratings. 6. Check the <i>TRIP/WARN</i> and <i>NETWORK STATUS</i> LEDs, or the <i>DEVICE STATUS</i> and <i>TRIP STATUS</i> parameters. If a Protection Fault exists, refer to the <i>Trip and Warning</i> troubleshooting procedure. If a DeviceNet-related fault exists, refer to the <i>DeviceNet</i> troubleshooting procedure. 7. Check the OUTA and OUTB Pr FltState, Pr FltValue, Dn FltState, Dn FltValue, Dn IdlState, and Dn IdlValue programmable parameters. The Pr FltState and Pr FltValue parameters supersede the Dn Flt or Dn Idle parameters.
OUT A or OUT B	Output A or Output B does not appear to turn off (open) when commanded to do so.	1. Check the OUTA and OUTB status LED's. If the appropriate LED remains illuminated, check the programmable controller ladder logic and I/O mapping. 2. If the appropriate Output LED is not illuminated, remove the control circuit power and check for continuity across the appropriate output terminals (13/14 for OUTA, 23/24 for OUTB). If the continuity test indicates the output is closed, replace the EC4 Current Monitoring Relay. Check the supply voltage against the ratings of the contactor and the relay output before installing a new unit. 3. Remove control circuit power and check the control circuit fuse and the control wiring to the EC4 Current Monitoring Relay output terminals. 4. Check the OUTA and OUTB Pr FltState, Pr FltValue, Dn FltState, Dn FltValue, Dn IdlState, and Dn IdlValue programmable parameters. Then check the <i>TRIP/WARN</i> and <i>NETWORK STATUS</i> LEDs, or the <i>DEVICE STATUS</i> and <i>TRIP STATUS</i> parameters. If a Protection Fault exists, refer to the <i>Trip and Warning</i> troubleshooting procedure. If a DeviceNet-related fault exists, refer to the <i>DeviceNet</i> troubleshooting procedure.
OUT A or OUT B	The contactor connected to Output A or Output B appears to "chatter"	1. Verify the OUT A or OUT B LED remains in the appropriate On or Off state. If the LED is flickering, check the programmable controller's ladder logic program. 2. Check the control circuit supply voltage. Verify it is within the ratings of the contactor coil and the current monitoring relay's outputs. 3. Remove the control circuit power. Verify all control wiring is properly secured.

❶ FRN 2.000 and later.

Specifications

Electrical Specifications

Table 1 - Motor/Load Ratings

Terminals	1/L1, 3/L2, 5/L3, 2/T1, 4/T2, 6/T3
Rated Insulation Voltage (Ui)	690V AC
Rated Operating Voltage (Ue) IEC: UL:	690V AC 600V AC
Rated Impulse Voltage (Uimp)	6 kV
Rated Operating Current (Ie)	See Catalog Number Explanation
Rated Frequency	20...250 Hz ❶
Short Circuit Ratings	See Chapter 2
Number of Poles	3
Application	Single-phase or Three-phase

❶ Exception: Any EC4 Current Monitoring Relay that uses an external ground fault sensor is limited to 50/60 Hz detection.

Table 2 - Power Supply Ratings

Terminals	DeviceNet Connector: V+ (Red), V- (Black)
Rated Supply Voltage (Us)	24V DC
Operating Range	11...25V DC
Rated Supply Current	See Chart Below
Maximum Surge Current at Power-Up	3 A
Maximum Power Consumption E3: E3 Plus:	3.2 W 3.9 W
Maximum Power Interruption Time @ 11V DC: @ 25V DC:	1 ms 10 ms

Table 3 - Output and Trip Relay Ratings

Terminals OUT A: OUT B (E3 Plus): Trip Relay:	13/14 23/24 95/96
Type of Contacts	Form A SPST - NO
Rated Thermal Current (I_{the})	5 A
Rated Insulation Voltage (U_i)	300V AC
Rated Operating Voltage (U_o)	240V AC
Rated Operating Current (I_o)	3 A (@120V AC), 1.5 A (@240V AC) 0.25 A (@110V DC), 0.1 A (@220V DC)
Minimum Operating Current	10 mA @ 5V DC
Rating Designation	B300
Utilization Category	AC-15
Resistive Load Rating (p.f. = 1.0)	5 A, 250V AC 5 A, 30V DC
Inductive Load Rating (L/R = 7 ms) (p.f. = 0.4)	2 A, 250V AC 2 A, 30V DC
Short Circuit Current Rating	1,000 A
Recommended Control Circuit Fuse	KTK-R-6 (6 A, 600 V)
Rated Number of Operations Trip Relay: OUT A and B: W/100-C09...100-C43 W/100-C60...100-C85 W/NEMA Size 0...2 W/NEMA Size 3	100,000 5,000,000 2,500,000 1,000,000 300,000

Table 4 - Input Ratings

Terminals IN 1: IN 2: IN 3 (E3 Plus): IN 4 (E3 Plus): Supply Voltage (24V DC):	1 2 3 4 5,6
Supply Voltage (provided by E3)	24V DC $\pm$ 10%
Type of Inputs	Current Sinking
On-State Voltage	15V DC
On-State Current (turn-on)	2 mA
Steady State Current	8 mA
Off-State Voltage	5V DC

Table 4 - Input Ratings

Off-State Current	0.5 mA
Transition Voltage	5...15V DC
Transition Current	0.5...2.0 mA

Table 5 - Thermistor/PTC Input Ratings

Terminals	1T1, 1T2
Type of Control Unit	Mark A
Maximum Number of Sensors	6
Maximum Cold Resistance of PTC Sensor Chain	1500 Ω
Trip Resistance	3400 $\Omega \pm 150 \Omega$
Reset Resistance	1600 $\Omega \pm 100 \Omega$
Short-circuit Trip Resistance	25 $\Omega \pm 10 \Omega$
Maximum Voltage @ PTC Terminals ($R_{PTC} = 4 \text{ k}\Omega$)	7.5V DC
Maximum Voltage @ PTC Terminals ($R_{PTC} = \text{open}$)	30V DC
Response Time	800 ms

Environmental Specifications

Table 6 - Environmental Specifications

Ambient Temperature	
Storage	–40°...+85°C (–40...+185°F)
Operating	
(Open)	–20°...+55°C (–4°...+131°F)
(Enclosed)	–20°...+40°C (–4°...+104°F)
Humidity	
Operating	5...95% Non-condensing
Damp Heat – Steady State (per IEC 68-2-3)	92% r.h., 40°C (104°F), 56 days
Damp Heat – Cyclic (per IEC 68-2-30)	93% r.h., 25°C/40°C (77°F/104°F), 21 Cycles
Cooling Method	Natural Convection
Vibration (per IEC 68-2-6)	3 G
Shock (per IEC 68-2-27)	30 G
Maximum Altitude	2000 m ❶
Pollution Environment	Pollution Degree 3
Terminal Marking	EN 50012
Degree of Protection	
193-ECxxx	IP20
592-ECxxx	

❶ Current ratings must be derated at altitudes greater than 2000 m

Electromagnetic Compatibility Specifications

Table 7 - Electromagnetic Compatibility Specifications

Electrostatic Discharge Immunity Test Level:	8kV Air Discharge 6kV Contact Discharge
Performance Criteria:	1 ❶❷
RF Immunity Test Level:	10V/m
Performance Criteria:	1 ❶❷
Electrical Fast Transient/Burst Immunity Test Level:	4kV (Power) 2kV (Control & Comm)
Performance Criteria:	1 ❶❷
Surge Immunity Test Level:	2kV (L-E) 1kV (L-L)
Performance Criteria:	1 ❶❷
Radiated Emissions	Class A
Conducted Emissions	Class A

❶ Performance Criteria 1 requires the DUT to experience no degradation or loss of performance.

❷ Environment 2.

Functionality Specifications

Table 8 - DeviceNet Communications

Baud Rate	125 k, 250 k, 500 k
Auto-Baud Rate Identification	Yes
“Group 2 – Slave Only” device type	Yes
Polled I/O Messaging	Yes
Change of State Messaging	Yes
Cyclic Messaging	Yes
Explicit Messaging	Yes
Full Parameter Object Support	Yes
Group 4 – Off-Line Node Recovery Messaging	Yes
Configuring Consistency Value	Yes
Unconnected Messaging Manager (UCMM)	Yes

Protection

Table 9 - Protection

	Trip	Warning
Undercurrent	Yes	Yes
Overcurrent	Yes	Yes
Line Loss	Yes	Yes

Table 9 - Protection

	Trip	Warning
Ground Fault (E3 Plus)	Yes	Yes
Communication Fault	Yes	Yes
Communication Idle	Yes	Yes
Remote Trip	Yes	No

Table 10 - Ground Fault Protection

Type	Core Balanced
Intended Use	Equipment Protection
Classification (Per UL 1053)	Class I
Protection Range	20...100 mA
	100...500 mA
	200 mA...1.0 A
	1.0...5.0 A
Trip & Warning Time Delay	0.1...25.0 s
Protection Inhibit Time	0...250 s

DeviceNet Information

Electronic Data Sheets

Electronic Data Sheet (EDS) files are specially formatted ASCII files that provide all of the information necessary for a configuration tool (e.g., RSNetWorx for DeviceNet) to access and alter the parameters of a device. The EDS file contains all the parameter information of a device: number of parameters, groupings, parameter name, min, max, and default values, units, data format and scaling.

EDS files for all EC4 Current Monitoring Relay units are available from the Internet at www.ab.com/networks/eds/index/html. They may also be built automatically by some configuration tools since all of the information necessary for an EDS file may be extracted from the EC4 Current Monitoring Relay.

IMPORTANT	DeviceLogix capability is not available when uploading the EDS from an EC4 Current Monitoring Relay. The EDS file must be obtained from the internet.
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Product Codes

Since the EC4 Current Monitoring Relay is available in a variety of current ranges, each model supports a parameter set that is slightly different in terms of min, max, and default values for parameters that are related to motor current. Therefore, each model uses an EDS file specific to that model. Configuration tools use “product codes” to identify which EDS file to use for a given device. The following table summarizes the various product codes.

DeviceNet Objects

The EC4 Current Monitoring Relay supports the following DeviceNet object classes.

Table 11 - DeviceNet Object Classes

Class	Object
0x01	Identity
0x02	Message Router
0x03	DeviceNet
0x04	Assembly
0x05	Connection
0x08	Discrete Input Point
0x09	Discrete Output Point
0x0F	Parameter
0x10	Parameter Group
0x29	Control Supervisor
0x2B	Acknowledge Handler
0xB4	DN Interface Object
0xC2	PCP Object

Identity Object – Class Code 0x01

The following class attributes are supported for the Identity Object:

Table 12 - Identity Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1

Three instances of the Identity Object will be supported. The following table shows what each instance will represent and what the revision attribute will report.

Table 13 - Revision Attribute Display

Instance	Description	Revision Attribute
1	Identifies the EC4 as a whole	The firmware revision of the OS stored in flash memory
2	Operating System Flash	The firmware revision of the OS stored in flash memory
3	Boot Code Flash	The firmware revision of the boot code stored in flash memory

Instance 1 of the Identity Object will contain the following attributes.

Table 14 - Identity Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Vendor ID	UINT	Programmable via test object
2	Get	Device Type	UINT	3
3	Get	Product Code	UINT	See following table

Table 14 - Identity Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
4	Get	Revision Major Minor	Structure of: USINT USINT	4 1
5	Get	Status	WORD	Bit 0 — 0 = Not owned, 1 = Owned by master Bit 2 — 0 = Factory Defaulted, 1 = Configured Bit 8 — Minor recoverable fault Bit 9 — Minor unrecoverable fault Bit 10 — Major recoverable fault Bit 11 — Major unrecoverable fault
6	Get	Serial Number	UDINT	Unique number for each device
7	Get	Product Name String Length ASCII String	Structure of: USINT STRING	Product Code-specific
8	Get	State	USINT	Returns the value “3 = Operational”
9	Get	Configuration Consistency Value	UINT	Unique value depending upon output of the parameter checksum algorithm
10	Get/Set	Heartbeat Interval	USINT	In seconds. Default = 0

The following common services are implemented for the Identity Object:

Table 15 - Identity Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single
0x05	No	Yes	Reset (DeviceNet only)

Message Router – Class Code 0x02

No class or instance attributes are supported. The message router object exists only to route explicit messages to other objects.

DeviceNet Object – Class Code 0x03

The following class attributes are supported for the DeviceNet Object:

Table 16 - DeviceNet Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	2

A single instance (instance 1) of the DeviceNet Object is supported. The following instance attributes are supported:

Table 17 - DeviceNet Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get/Set	MAC ID	USINT	0...63
2	Get/Set	Baud Rate	USINT	0 = 125 kbaud 1 = 250 kbaud 2 = 500 kbaud
5	Get	Allocation Information Allocation's Choice Byte Master's MAC ID	Structure of: BYTE USINT	Allocation byte ❶ 0...63 = address 255 = unallocated

❶ Allocation byte

- Bit 0 Explicit Messaging
- Bit 1 Polled I/O
- Bit 4 Change of State I/O
- Bit 5 Cyclic I/O
- Bit 6 Acknowledge Suppress I/O

The following services are implemented for the DeviceNet Object:

Table 18 - DeviceNet Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single
0x4B	No	Yes	Allocate_Master/Slave_Connection_Set
0x4C	No	Yes	Release_Master/Slave_Connection_Set

Assembly Object – Class Code 0x04

Output Assemblies

The following Assembly Instances are implemented. Note that most of these assemblies are part of the “motor control hierarchy” of the DeviceNet specification. Other vendor specific assemblies have been added to allow the monitoring of the auxiliary inputs, etc.

Table 19 - Assembly Object Instance 2 Data Format (“TRIP RESET CMD”)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						Fault Reset		

The following assemblies are similar to those found in the Motor Starter Profile. The only difference is that OutA and OutB map to Discrete Output Points instead of the Control Supervisor. The instance numbers are 100 plus the number assigned in corresponding assemblies in the Motor Starter Profile.

Table 20 - Assembly Object Instance 101 Data Format ("OUT A CMD")

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
0								OutA

Table 21 - Assembly Object Instance 103 Data Format ("BASIC CMD")

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
0			Remote Trip			Fault Reset		OutA

Table 22 - Assembly Object Instance 104 Data Format ("OUTPUT CMD")

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
0							OutB	OutA

Table 23 - Assembly Object Instance 105 Data Format ("COMMAND")

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
0			Remote Trip			Fault Reset	OutB	OutA

Table 24 - Assembly Object Instance 140 Data Format ("DEVICELOGIX CMD")

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
0						Fault Reset	OutB	OutA
1	Network Input 7	Network Input 6	Network Input 5	Network Input 4	Network Input 3	Network Input 2	Network Input 1	Network Input 0
2	Network Input 15	Network Input 14	Network Input 13	Network Input 12	Network Input 11	Network Input 10	Network Input 9	Network Input 8

Input Assemblies

Table 25 - Assembly Object Instance 50 Data Format ("TRIP STATUS")

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
0								Faulted

Table 26 - Assembly Object Instance 51 Data Format ("TRIP WARN STATUS")

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
0							Warning	Faulted

Table 27 - Assembly Object Instance 106 Data Format ("BASIC STATUS")

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
0			Input2	Input1		OutA_Stat	Warning	Faulted

Table 28 - Assembly Object Instance 107 Data Format ("STATUS")

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
0	Input4	Input3	Input2	Input1	OutB_Stat	OutA_Stat	Warning	Faulted

Table 29 - Assembly Object Instance 141 Data Format ("DEVICELOGIX STAT")

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
0	Input4	Input3	Input2	Input1	OutB_Stat	OutA_Stat	Warning	Faulted
1	Network Output 7	Network Output 6	Network Output 5	Network Output 4	Network Output 3	Network Output 2	Network Output 1	Network Output 0
2	DeviceLogix Enabled	Network Output 14	Network Output 13	Network Output 12	Network Output 11	Network Output 10	Network Output 9	Network Output 8

Table 30 - Assembly Object Instance 184 Data Format ("PNB STATUS")

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
0	Network Output 7	Network Output 6	Network Output 5	Network Output 4	Network Output 3	Network Output 2	Network Output 1	Network Output 0
1	DeviceLogix Enabled	Network Output 14	Network Output 13	Network Output 12	Network Output 11	Network Output 10	Network Output 9	Network Output 8

Table 31 - Assembly Object Instance 100 Attributes ("PARAMETER BASED")

Byte	Word	Value
0	0	Value of parameter pointed to by param #61 (Low Byte)
1		Value of parameter pointed to by param #61 (High Byte)
2	1	Value of parameter pointed to by param #62 (Low Byte)
3		Value of parameter pointed to by param #62 (High Byte)
4	2	Value of parameter pointed to by param #63 (Low Byte)
5		Value of parameter pointed to by param #63 (High Byte)
6	3	Value of parameter pointed to by param #64 (Low Byte)
7		Value of parameter pointed to by param #64 (High Byte)

The following tables indicate the I/O Assembly Data Attribute mapping for Parameter Link-Based Assemblies:

Table 32 - Instance 110 Data Link Output Assembly Attributes ("PARAM LINK CMD")

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
0			Remote Trip			Fault Reset	Output B	Output A
1	Reserved							

**Table 32 - Instance 110 Data Link Output Assembly Attributes
("PARAM LINK CMD")**

2	Network Input 7	Network Input 6	Network Input 5	Network Input 4	Network Input 3	Network Input 2	Network Input 1	Network Input 0
3	Network Input 15	Network Input 14	Network Input 13	Network Input 12	Network Input 11	Network Input 10	Network Input 9	Network Input 8
4	Status Parameter A (low)							
5	Status Parameter A (high)							
6	Status Parameter B (low)							
7	Status Parameter B (high)							

Table 33 - Instance 111 Data Link Input Assembly Attributes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Parameter A Number (low)							
1	Parameter A Number (high)							
2	Parameter A Data (low)							
3	Parameter A Data (high)							
4	Parameter B Number (low)							
5	Parameter B Number (high)							
6	Parameter B Data (low)							
7	Parameter B Data (high)							

Connection Object – Class Code 0x05

The following class attributes are supported for the Connection Object:

Table 34 - Connection Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1

Three instances of the Connection Object are supported. Instance 1 is the explicit message connection, instance 2 is the polled I/O connection, and instance 4 is the Change of State/Cyclic I/O connection.

The following instance 1 (explicit message connection) attributes are supported:

Table 35 - Connection Object Instance 1 Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0 = Nonexistent 1 = Configuring 3 = Established 4 = Timed out
2	Get	Instance Type	USINT	0 = Explicit message
3	Get	Transport Class Trigger	BYTE	0x83 (Class 3 Server)
4	Get	Produced Connection ID	UINT	10xxxxxx011 xxxxxx = Node address
5	Get	Consumed Connection ID	UINT	10xxxxxx100 xxxxxx = Node address
6	Get	Initial Comm Characteristics	BYTE	0x22
7	Get	Produced Connection Size	UINT	0x61
8	Get	Consumed Connection Size	UINT	0x61
9	Get/Set	Expected Packet Rate	UINT	in ms
12	Get/Set	Watchdog Action	USINT	1 = Auto delete 3 = Deferred delete
13	Get	Produced Connection Path Length	UINT	0
14	Get	Produced Connection Path		Null (no data)
15	Get	Consumed Connection Path Length	UINT	0
16	Get	Consumed Connection Path		Null (no data)

The following instance 2 (polled I/O connection) attributes are supported.

Table 36 - Connection Object Instance 2 Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0 = Nonexistent 1 = Configuring 3 = Established 4 = Timed out
2	Get	Instance Type	USINT	1 = I/O Message
3	Get	Transport Class Trigger	BYTE	If alloc choice = polled OR If alloc choice = !polled && !ack suppressed: 0x82 (Server Class 2) If alloc choice = !polled && ack suppressed: 0x80 (Server Class 0)
4	Get	Produced Connection ID	UINT	01111xxxxx xxxxxx = Node address

Table 36 - Connection Object Instance 2 Attributes

Attribute ID	Access Rule	Name	Data Type	Value
5	Get	Consumed Connection ID	UINT	10xxxxxx101 xxxxxx = Node address
6	Get	Initial Comm Characteristics	BYTE	0x21
7	Get	Produced Connection Size	UINT	0...8
8	Get	Consumed Connection Size	UINT	0...8
9	Get/Set	Expected Packet Rate	UINT	in ms
12	Get/Set	Watchdog Action	USINT	0 = Transition to timed out 1 = Auto delete 2 = Auto reset
13	Get	Produced Connection Path Length	UINT	8
14	Get/Set	Produced Connection Path	EPATH	21 04 00 25 (assy. inst.) 00 30 03
15	Get	Consumed Connection Path Length	UINT	8
16	Get/Set	Consumed Connection Path	EPATH	21 04 00 25 (assy. inst.) 00 30 03

The following instance 4 (Change of State/Cyclic I/O connection) attributes are supported:

Table 37 - Connection Object Instance 4 Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0 = Nonexistent 1 = Configuring 3 = Established 4 = Timed out
2	Get	Instance Type	USINT	1 = I/O Message
3	Get	Transport Class Trigger	BYTE	Cyclic: 0x03 Cyclic Ack Suppressed: 0x00 COS: 0x13 COS Ack Suppressed: 0x10
4	Get	Produced Connection ID	UINT	01101xxxxxx xxxxxx = Node address
5	Get	Consumed Connection ID	UINT	10xxxxxx010 xxxxxx = Node address
6	Get	Initial Comm Characteristics	BYTE	0x02 (acknowledged) 0x0F (unacknowledged)
7	Get	Produced Connection Size	UINT	0...8
8	Get	Consumed Connection Size	UINT	0...8
9	Get/Set	Expected Packet Rate	UINT	in ms

Table 37 - Connection Object Instance 4 Attributes

Attribute ID	Access Rule	Name	Data Type	Value
12	Get/Set	Watchdog Action	USINT	0 = Transition to timed out 1 = Auto delete 2 = Auto reset
13	Get	Produced Connection Path Length	UINT	8
14	Get/Set	Produced Connection Path	EPATH	21 04 00 25 (assy. inst.) 00 30 03
15	Get	Consumed Connection Path Length	UINT	8
16	Get/Set	Consumed Connection Path	EPATH	21 04 00 25 (assy. inst.) 00 30 03

The following instances 5...7 (Group 3 Explicit Message Connections Allocated through UCMM) are supported:

Table 38 - Connection Object Instances 5...7 Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0 = Nonexistent 1 = Configuring 3 = Established 4 = Timed out
2	Get	Instance Type	USINT	0 = Explicit Message
3	Get	Transport Class Trigger	BYTE	0x83 — Server, Transport Class 3
4	Get	Produced Connection ID	UINT	Depends on message group and message ID
5	Get	Consumed Connection ID	UINT	Depends on message group and message ID
6	Get	Initial Comm Characteristics	BYTE	0x33 (Group 3)
7	Get	Produced Connection Size	UINT	0
8	Get	Consumed Connection Size	UINT	
9	Get/Set	Expected Packet Rate	UINT	in ms
12	Get	Watchdog Action	USINT	01 = Auto delete 03 = Deferred delete
13	Get	Produced Connection Path Length	UINT	0
14	Get	Produced Connection Path		Empty
15	Get	Consumed Connection Path Length	UINT	0
16	Get	Consumed Connection Path		Empty

The following common services are implemented for the Connection Object:

Table 39 - Connection Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x05	No	Yes	Reset (Connection Object Only)
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Discrete Input Point Object – Class Code 0x08

The following class attributes are supported for the Discrete Input Object:

Table 40 - Discrete Input Point Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	2
2	Get	Max Instances	UINT	2 or 4

Multiple instances of the Discrete Input Object are supported, one instance for each general purpose discrete input on the EC4 Current Monitoring Relay. All instances will contain the following attributes:

Table 41 - Discrete Input Point Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
3	Get	Value	BOOL	Input Point Value. 0 = OFF; 1 = ON

The following common services will be implemented for the Discrete Input Point Object:

Table 42 - Discrete Input Point Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single

Discrete Output Point Object – Class Code 0x09

The following class attributes are supported for the Discrete Output Point Object:

Table 43 - Discrete Output Point Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1
2	Get	Max Instances	UINT	1 or 2

Multiple instances of the Discrete Output Point Object are supported, one instance for each general purpose discrete output on the EC4 Current Monitoring Relay. All instances will contain the following attributes:

Table 44 - Discrete Output Point Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
3	Get/Set	Value	BOOL	Output point value. 0 = OFF; 1 = ON
5	Get/Set	Fault Action	BOOL	0 = Go to fault value 1 = Hold last state
6	Get/Set	Fault Value	BOOL	0 = OFF 1 = ON
7	Get/Set	Idle Action	BOOL	0 = Go to Idle Action 1 = Hold Last State
8	Get/Set	Idle Value	BOOL	0 = OFF 1 = ON
113	Get/Set	Protection Fault Action	BOOL	0 = Go to Pr Fault Value 1 = Ignore
114	Get/Set	Protection Fault Value	BOOL	0 = OFF 1 = ON

The following common services are implemented for the Discrete Output Point Object:

Table 45 - Discrete Output Point Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Parameter Object – Class Code 0x0F

The following class attributes are supported for the Parameter Object:

Table 46 - Parameter Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1
2	Get	Max Instances	UINT	Product Code Dependent
8	Get	Parameter Class Descriptor	WORD	0x03
10	Get	Native Language	USINT	1 = English

Multiple instances of the Parameter Object are supported. All instances will contain the following attributes:

Table 47 - Parameter Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get/Set (Only Get is supported for monitoring parameters)	Parameter Value	See Data Type & Data Size Attributes	
2	Get	Link Path Size	USINT	08
3	Get	Link Path Segment Type/Port Segment Address	BYTE Path Data Dependent	Path to specific device object attribute if applicable
4	Get	Descriptor	WORD	Parameter Dependent: 0000000000ab0cd0 a - Monitoring Parameter b - Read Only Parameter c - Scaled Parameter d - Enumerated String
5	Get	Data Type	USINT	Parameter Dependent
6	Get	Data Size	USINT	Parameter Dependent
7	Get	Parameter Name	SHORT_STRING	Parameter Dependent
8	Get	Units String	SHORT_STRING	Parameter Dependent
10	Get	Minimum Value	Data Type	Parameter Dependent
11	Get	Maximum Value	Data Type	Parameter Dependent
12	Get	Default Value	Data Type	Parameter Dependent
13	Get	Scaling Multiplier	UINT	01
14	Get	Scaling Divisor	UINT	01
15	Get	Scaling Base	UINT	01
16	Get	Scaling Offset	INT	00
17	Get	Multiplier Link	UINT	0
18	Get	Divisor Link	UINT	0
19	Get	Base Link	UINT	0
20	Get	Offset Link	UINT	0
21	Get	Decimal Precision	USINT	Parameter Dependent

The following common services will be implemented for the Parameter Object:

Table 48 - Parameter Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single
0x01	No	Yes	Get_Attributes_All
0x4B	No	Yes	Get_Enum_String

Parameter Group Object – Class Code 0x10

The following class attributes are supported for the Parameter Group Object:

Table 49 - Parameter Group Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1
2	Get	Max Instances	UINT	7
8	Get	Native Language	USINT	1 = English

The following instances of the Parameter Group Object are supported:

Table 50 - Parameter Group Object Instance 1 – Monitor Parameters

Attribute ID	Access Rule	Name	Data Type	Value	Parameter Name
1	Get	Group Name String	SHORT_STRING	"Monitor Params"	
2	Get	Number of Members	UINT	23	
3	Get	1 st Parameter No.	UINT	1	
4	Get	2 nd Parameter No.	UINT	2	
5	Get	3 rd Parameter No.	UINT	3	
6	Get	4 th Parameter No.	UINT	4	
7	Get	5 th Parameter No.	UINT	5	
8	Get	6 th Parameter No.	UINT	6	
9	Get	7 th Parameter No.	UINT	7	
10	Get	8 th Parameter No.	UINT	8	
11	Get	9 th Parameter No.	UINT	9	
12	Get	10 th Parameter No.	UINT	10	
13	Get	11 th Parameter No.	UINT	11	
14	Get	12 th Parameter No.	UINT	12	
15	Get	13 th Parameter No.	UINT	13	
16	Get	14 th Parameter No.	UINT	14	

Table 50 - Parameter Group Object Instance 1 – Monitor Parameters

Attribute ID	Access Rule	Name	Data Type	Value	Parameter Name
17	Get	15 th Parameter No.	UINT	15	
18	Get	16 th Parameter No.	UINT	16	
19	Get	17 th Parameter No.	UINT	17	
20	Get	18 th Parameter No.	UINT	18	
21	Get	19 th Parameter No.	UINT	19	
22	Get	20 th Parameter No.	UINT	20	
23	Get	21 st Parameter No.	UINT	21	
24	Get	22 nd Parameter No.	UINT	22	
25	Get	23 rd Parameter No.	UINT	23	

Table 51 - Parameter Group Object Instance 3 – Reset/Lock Parameters

Attribute ID	Access Rule	Name	Data Type	Value	Parameter Name
1	Get	Group Name String	SHORT_STRING	"Reset/Lock"	
2	Get	Number of Members	UINT	3	
3	Get	1 st Parameter No.	UINT	26	Trip Reset
4	Get	2 nd Parameter No.	UINT	53	Program Lock
5	Get	3 rd Parameter No.	UINT	54	Set to Defaults
103					Test Enable
104					Clear Queues

Table 52 - Parameter Group Object Instance 4 – Advanced Setup Parameters

Attribute ID	Access Rule	Name	Data Type	Value	Parameter Name
1	Get	Group Name String	SHORT_STRING	"Advanced Setup"	
2	Get	Number of Members	UINT	36	
3	Get	1 st Parameter No.	UINT	24	
4	Get	2 nd Parameter No.	UINT	25	
5	Get	3 rd Parameter No.	UINT	27	
6	Get	4 th Parameter No.	UINT	28	
7	Get	5 th Parameter No.	UINT	29	
8	Get	6 th Parameter No.	UINT	30	
9	Get	7 th Parameter No.	UINT	31	

Table 52 - Parameter Group Object Instance 4 – Advanced Setup Parameters

Attribute ID	Access Rule	Name	Data Type	Value	Parameter Name
10	Get	8 th Parameter No.	UINT	32	
11	Get	9 th Parameter No.	UINT	33	
12	Get	10 th Parameter No.	UINT	34	
13	Get	11 th Parameter No.	UINT	35	
14	Get	12 th Parameter No.	UINT	36	
15	Get	13 th Parameter No.	UINT	37	
16	Get	14 th Parameter No.	UINT	38	
17	Get	15 th Parameter No.	UINT	39	
18	Get	16 th Parameter No.	UINT	40	
19	Get	17 th Parameter No.	UINT	41	
20	Get	18 th Parameter No.	UINT	42	
21	Get	19 th Parameter No.	UINT	43	
22	Get	20 th Parameter No.	UINT	44	
23	Get	21 st Parameter No.	UINT	45	
24	Get	22 nd Parameter No.	UINT	46	
25	Get	23 rd Parameter No.	UINT	47	
26	Get	24 th Parameter No.	UINT	48	
27	Get	25 th Parameter No.	UINT	49	
28	Get	26 th Parameter No.	UINT	50	
29	Get	27 th Parameter No.	UINT	51	
30	Get	28 th Parameter No.	UINT	52	
31	Get	29 th Parameter No.	USINT	78	
32	Get	30 th Parameter No.	USINT	83	
33	Get	31 st Parameter No.	USINT	84	
34	Get	32 nd Parameter No.	USINT	85	
35	Get	33 rd Parameter No.	USINT	86	
36	Get	34 th Parameter No.	USINT	87	
37	Get	35 th Parameter No.	UINT	88	
38	Get	36 th Parameter No.	USINT	89	
				99	
				100	
				101	

Table 52 - Parameter Group Object Instance 4 – Advanced Setup Parameters

Attribute ID	Access Rule	Name	Data Type	Value	Parameter Name
				102	
				105	
				106	

Table 53 - Parameter Group Object Instance 5 – DeviceNet Setup Parameters

Attribute ID	Access Rule	Name	Data Type	Value	Parameter Name
1	Get	Group Name String	SHORT_STRING	"DNet Setup"	
2	Get	Number of Members	UINT	9	
3	Get	1 st Parameter No.	UINT	55	AutoBaudEnable
4	Get	2 nd Parameter No.	UINT	56	Nonvolatile Baud
5	Get	3 rd Parameter No.	UINT	58	COS Mask
6	Get	4 th Parameter No.	UINT	59	Output Assembly
7	Get	5 th Parameter No.	UINT	60	InputAssembly
8	Get	6 th Parameter No.	UINT	61	Assy Word0 Param
9	Get	7 th Parameter No.	UINT	62	Assy Word1 Param
10	Get	8 th Parameter No.	UINT	63	Assy Word2 Param
11	Get	9 th Parameter No.	UINT	64	Assy Word3 Param
				79	Comm Override
				80	Network Override
				81	Net Outputs
				82	Net Out COS Mask

Table 54 - Parameter Group Object Instance 6 – Output Setup Parameters

Attribute ID	Access Rule	Name	Data Type	Value	Parameter Name
1	Get	Group Name String	SHORT_STRING	"Output Setup"	
2	Get	Number of Members	UINT	12	
3	Get	1 st Parameter No.	UINT	65	OutA Pr FltState
4	Get	2 nd Parameter No.	UINT	66	OutA Pr FltValue
5	Get	3 rd Parameter No.	UINT	67	OutA Dn FltState
6	Get	4 th Parameter No.	UINT	68	OutA Dn IdlValue
7	Get	5 th Parameter No.	UINT	69	OutA Dn IdlState
8	Get	6 th Parameter No.	UINT	70	OutA Dn IdlValue

Table 54 - Parameter Group Object Instance 6 – Output Setup Parameters

Attribute ID	Access Rule	Name	Data Type	Value	Parameter Name
9	Get	7 th Parameter No.	UINT	71	OutB Pr FltState
10	Get	8 th Parameter No.	UINT	72	OutB Pr FltValue
11	Get	9 th Parameter No.	UINT	73	OutB Dn FltState
12	Get	10 th Parameter No.	UINT	74	OutB Dn IdlValue
13	Get	11 th Parameter No.	UINT	75	OutB Dn IdlState
14	Get	12 th Parameter No.	UINT	76	OutB Dn IdlValue

Table 55 - Parameter Group Object Instance 7 – DeviceLogix Parameters

Attribute ID	Access Rule	Name	Data Type	Value	Parameter Name
1	Get	Group Name String	SHORT_STRING	“DeviceLogix”	
2	Get	Number of Members	UINT	4	
3	Get	1 st Parameter No.	BOOL	79	Comm Override
4	Get	2 nd Parameter No.	BOOL	80	Network Override
5	Get	3 rd Parameter No.	UINT	81	Net Outputs
6	Get	4 th Parameter No.	UINT	82	Net Out COS Mask

The following common services are implemented for the Parameter Group Object:

Table 56 - Parameter Group Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single

Control Supervisor Object – Class Code 0x29

The following class attributes are supported for the Control Supervisor Object:

Table 57 - Control Supervisor Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1

The following instance attributes are supported for the Control Supervisor Object.

Table 58 - Control Supervisor Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
10	Get	Tripped	BOOL	0 = No Fault present 1 = Fault Latched
11	Get	Warning	BOOL	0 = No Warning present 1 = Warning present (not latched)
12	Get/Set	Fault Reset	BOOL	0->1 = Trip Reset otherwise no action
13	Get	Trip Code	UINT	ODVA Trip Code – In trip state indicates cause of trip; If not tripped, indicates cause of last trip.
14	Get	Warning Code	UINT	ODVA Warning Code - In warning state indicates cause of warning; If no warning, indicates cause of last warning.
17	Get/Set	Force Trip	BOOL	0->1 = Trip. Test trip generated. This attribute returns object state conflict when "Test Enable" bitr is set in Trip Enable.
100	Get	Elapsed Time	UINT	Logs motor-on (Current Present) hours.
101	Get	Starts Counter	UINT	Logs the number of motor starts.
106	Get/Set	PM – Start Count	UINT	The Preventative Maintenance Start Count flag is set after this number of starts
107	Get/Set	PM – Oper Hours	UINT	The Preventative Maintenance Operating Hours flag is set after this number of hours
108	Get/Set	Test Enable	BOOL	Enables/Disables the Test Button.
109	Get	Warning Log 0	WORD	Enumerated same as attribute 115
110	Get	Warning Log 1	WORD	Enumerated same as attribute 115
111	Get	Warning Log 2	WORD	Enumerated same as attribute 115
112	Get	Warning Log 3	WORD	Enumerated same as attribute 115
113	Get	Warning Log 4	WORD	Enumerated same as attribute 115
114	Get	Trip Status	WORD	Bit 0 = Test Trip Bit 1 = Overload Bit 2 = Phase Loss Bit 3 = Ground Fault ** Bit 4 = Stall Bit 5 = Jam Bit 6 = Underload Bit 7 = PTC ** Bit 8 = Current Imbal Bit 9 = Comm Fault Bit 10 = Comm Idle Bit 11 = NonVol Mem Bit 12 = Hardware Fault Bit 13 = Reserved Bit 14 = Remote Trip Bit 15 = Blocked Start

Table 58 - Control Supervisor Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
115	Get	Warning Status	WORD	Bit 0 = Reserved Bit 1 = Overload Bit 2 = Phase Loss Bit 3 = Ground Fault ** Bit 4 = Reserved Bit 5 = Jam Bit 6 = Underload Bit 7 = PTC ** Bit 8 = Current Imbal Bit 9 = Comm Fault Bit 10 = Comm Idle Bit 11 = Reserved Bit 12 = Config Fault Bit 13 = PM Starts Bit 14 = PM Oper Hours
116	Get	Trip Log 0	WORD	Last trip condition. Bit definitions of the value are the same as attribute 114
117	Get	Trip Log 1	WORD	Last trip condition. Bit definitions of the value are the same as attribute 114
118	Get	Trip Log 2	WORD	Last trip condition. Bit definitions of the value are the same as attribute 114
119	Get	Trip Log 3	WORD	Last trip condition. Bit definitions of the value are the same as attribute 114
120	Get	Trip Log 4	WORD	Last trip condition. Bit definitions of the value are the same as attribute 114
121	Get	Device Status	WORD	Bit 0 = Trip Bit 1 = Warning Bit 2 = OutputA Bit 3 = OutputB Bit 4 = Input 1 Bit 5 = Input 2 Bit 6 = Input 3 Bit 7 = Input 4 Bit 8 = Motor Current Bit 9 = GF Current
124	Get/Set	Trip Enable	WORD	Bit 0 = Reserved Bit 1 = Overload Bit 2 = Phase Loss Bit 3 = Ground Fault ** Bit 4 = Stall Bit 5 = Jam Bit 6 = Underload Bit 7 = PTC ** Bit 8 = Current Imbal Bit 9 = Comm Fault Bit 10 = Comm Idle Bit 11 = Reserved Bit 12 = Reserved Bit 13 = Reserved Bit 14 = Remote Trip Bit 15 = Start Inhibit
125	Get/Set	Warning Eanble	WORD	Bit 0 = Reserved Bit 1 = Overload Bit 2 = Phase Loss Bit 3 = Ground Fault ** Bit 4 = Stall Bit 5 = Jam Bit 6 = Underload Bit 7 = PTC ** Bit 8 = Current Imbal Bit 9 = Comm Fault Bit 10 = Comm Idle Bit 11 = Reserved Bit 12 = Device Config Bit 13 = PM Starts Bit 14 = PM Oper Hours

Table 58 - Control Supervisor Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
126	Get/Set	Trip Reset	BOOL	0->1 = Trip Reset otherwise no action
130	Get/Set	Reset Mode	BOOL	0 = Manual 1 = Automatic
131	Get/Set	OL Reset Level	USINT	%FLA
132	Get/Set	Clear Queues	BOOL	0->1 = Clear fault and warning queues, start counters and operating hour accumulators otherwise no action
177	Get/Set	IN1 Assignment	USINT	0 = Normal 1 = Trip Reset 2 = Remote Trip 3 = 2 Speed
178	Get/Set	IN2 Assignment	USINT	0 = Normal 1 = Trip Reset 2 = Remote Trip 3 = 2 Speed
179	Get/Set	IN3 Assignment	USINT	0 = Normal 1 = Trip Reset 2 = Remote Trip 3 = 2 Speed
180	Get/Set	IN4 Assignment	USINT	0 = Normal 1 = Trip Reset 2 = Remote Trip 3 = 2 Speed

The following common services are implemented for the Control Supervisor Object:

Table 59 - Control Supervisor Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single
0x05	No	Yes	Reset

Acknowledge Handler Object – 0x2B

The following class attributes are supported for the Acknowledge Handler Object:

Table 60 - Acknowledge Handler Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1

A single instance (instance 1) of the Acknowledge Handler Object is supported. The following instance attributes are supported:

Table 61 - Acknowledge Handler Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get/Set	Acknowledge Timer	UINT	in milliseconds
2	Get/Set	Retry Limit	USINT	0 or 1
3	Get	COS Producing Connection Instance	UINT	4

The following common services are implemented for the Acknowledge Handler Object:

Table 62 - Acknowledge Handler Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

DeviceNet Interface Object – Class Code 0xB4

This “vendor specific” object includes no class attributes. A single instance (instance 1) of the DeviceNet Interface Object is supported. The following instance attributes are supported.

Table 63 - DeviceNet Interface Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Min/Max	Default	Desc.
1	Get	ZeroByte	USINT	0	0	Returns zero
2	Get	ZeroWord	UINT	0	0	Returns zero
5	Get/Set	Nonvolatile MAC ID	USINT	0...63	63	Stored value of MAC ID
6	Get/Set	Nonvolatile baud	USINT	0...2	0	Stored value of baud rate
7	Get/Set	Assy Word 0 Param	USINT	0...89	21	Parameter number whose value is used as the first word in Input Assembly 100
8	Get/Set	Assy Word 1 Param	USINT	0...89	1	Parameter number whose value is used as the second word in Input Assembly 100
9	Get/Set	Assy Word 2 Param	USINT	0...89	2	Parameter number whose value is used as the third word in Input Assembly 100
10	Get/Set	Assy Word 3 Param	USINT	0...89	3	Parameter number whose value is used as the fourth word in Input Assembly 100
12	Get	Firmware Rev	UINT	0...65.535		Firmware revision in EDS viewable format

Table 63 - DeviceNet Interface Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Min/Max	Default	Desc.
13	Get/Set	COS Mask	WORD	—	0	Change of state mask for DeviceNet
15	Get/Set	AutoBaudEnable	BOOL	0...1	1	1 = Enabled
16	Get/Set	Output Assembly	USINT	2, 101, 103, 104, 105, 140	103	Output Assembly instance that is active
17	Get/Set	Input Assembly	USINT	50, 51, 100, 106, 107, 141, 184	100	Input Assembly instance that is active
18	Get/Set	Program Lock	BOOL	0...1	0	0 = Unlocked 1 = Locked
19	Get/Set	Set To Defaults	BOOL	0...1	0	0 = No action 1 = Reset
20	Get	Device Configuration	WORD	0...7		Bit 0 set = 4 in/2 out hardware present Bit 1 set = PTC hardware present Bit 2 set = Ground Fault hardware present
50	Get/Set	PNB COS Mask	WORD	0...0xFF	0	Change of State mask for PNB

Table 64 - DeviceNet Interface Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

ODVA Fault Codes

The following ODVA fault codes are returned by the Control Supervisor Object instance attribute 13 “TripCode:”

Table 65 - ODVA Fault Codes

Trip Code	Description	Trip Code	Description
62	Memory Fault	73	Starts/Hour Exceeded
10	Test Trip	102	Comm Fault
11	Remote Trip	103	Comm Idle Fault
23	L1 Loss	108	L2 Undercurrent
24	L2 Loss	109	L3 Undercurrent
25	L3 Loss	110	L1 Overcurrent
27	Ground Fault	111	L2 Overcurrent

Table 65 - ODVA Fault Codes

Trip Code	Description	Trip Code	Description
28	Jam	112	L3Overcurrent
60	Hardware / Config Flt		
62	Non-Volatile Memory		

Logic Supervisor Object - CLASS CODE 0x030E

A single instance (instance 1) will be supported. The following instance attributes will be supported.

Table 1: Logic Supervisor Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Range	Value
1	Get/Set	Logic Enable	BOOL	0=Logic Disabled 1=Logic Enabled	0
2	Get	Data Table	Array of BYTE	The Standard Bit Table	0
5	Get	Last Error	UDINT	Last error code	65
6	Get	FB Classes Implemented	STRUCT of: USINT Array of UINT	4 775, 776, 777, 778	0x3F

The following common services will be implemented for the Logic Supervisor Object.

Table 2: Logic Supervisor Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x08	No	Yes	Reset
0x0E	No	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Status Object - CLASS CODE 0x0375

The following instance attributes are for the EC4 Current Monitoring Relay:

Table 3: EC4 Status Object Instance Attributes

Attribute	Name	Byte	Data
1	Phase / Gnd Currents	0	L1 Current
		1	
		2	L2 Current
		3	
		4	L3 Current
		5	
		6	Ground Current
		7	

Table 3: EC4 Status Object Instance Attributes

Attribute	Name	Byte	Data
4	I Trip / Warning	0	I Trip Status
		1	
		2	I Trip Warning
		3	
5	I Trip Log	0	I Trip Log 0
		1	I Trip Log 1
		2	
		3	I Trip Log 2
		4	
		5	I Trip Log 3
		6	
		7	I Trip Log 4
		8	
6	Device Data	9	
		0	Device Status
		1	Firmware
		2	
		3	Device Configuration
		4	
7	I Warning Log	5	
		0	I Warn Log 0
		1	I Warn Log 1
		2	
		3	I Warn Log 2
		4	
		5	I Warn Log 3
		6	
		7	I Warn Log 4
		8	
9	Network Outputs	9	
		0	Network Outputs
10	Trip History	1	Trip History 0
		0	
		2	Trip History 1
		1	
		3	Trip History 2
		2	
		4	Trip History 3
		3	
		5	Trip History 4
		4	
		6	
		7	
		8	
		9	

Table 3: EC4 Status Object Instance Attributes

Attribute	Name	Byte	Data
11	Warning History	0	Warn History 0
		1	
		2	
		3	Warn History 1
		4	
		5	Warn History 2
		6	
		7	Warn History 3
		8	
		9	Warn History 4
12	Trip Snapshot	0	SS L1 Current
		1	
		2	SS L2 Current
		3	
		4	SS L3 Current
		5	
		6	SS GF Current
		7	

The following common services will be implemented.

Table 4: EC4 Status Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x03	No	Yes	Get_Attribute_List
0x0E	No	Yes	Get_Attribute_Single

CE Compliance

The EC4 Current Monitoring Relay is intended for use in a heavy industrial environment. It is CE marked for conformity to the Low Voltage Directive 73/23/EEC (as amended by 93/68/EEC), the EMC Directive 89/336/EEC (as amended by 92/31/EEC and 93/68/EEC), and the ATEX Directive 94/9/EC, when installed as described in this manual.

IMPORTANT The conformity of the EC4 Current Monitoring Relay to these standards does not guarantee that an entire installation will conform. Many other factors can influence the entire installation and only direct measurements can verify total system conformity. It is therefore the responsibility if the installer to ensure system conformity.

European Communities (EC) Directive Compliance

To obtain a copy of the EC4 Current Monitoring Relay's Declaration of Conformity (DoC), contact your local Allen-Bradley distributor or go to <http://www.ab.com/certification/#CEmark>.

EMC Directive

This product is tested to meet Electromagnetic Compatibility (EMC) Directive 89/336/EC, as amended by 92/31/EEC and 93/68/EEC, by applying the following standards (in whole or in part), and as documented in a technical construction file:

- EN 60947-4-1 – Low Voltage Switchgear and Control Gear; Part 4 – Contactors and Motor Starters, Section 1 – Electromechanical Contactors and Motor Starters
- EN 60947-5-1 – Low Voltage Switchgear and Control Gear; Part 5 – Control Circuit Devices and Switching Devices, Section 1 – Electromechanical Control Circuit Devices

IMPORTANT The grounding requirements specified in this manual must be followed by the installer in order for the product to comply with the EMC directive.



ATTENTION: This is a Class A (heavy industrial) product. In a Class B (light industrial or domestic) environment, this product may cause radio interference, in which case the installer may be required to take additional measures to mitigate it.

Low Voltage Directive

This product is tested to meet Low Voltage Directive 73/23/EEC, as amended by 93/68/EEC, by applying the following standards (in whole or in part), and as documented in a technical construction file:

- EN 60947-4-1 – Low Voltage Switchgear and Control Gear; Part 4 – Contactors and Motor Starters, Section 1 – Electromechanical Contactors and Motor Starters
- EN 60947-5-1 – Low Voltage Switchgear and Control Gear; Part 5 – Control Circuit Devices and Switching Devices, Section 1 – Electromechanical Control Circuit Devices
- EN 60947-8 – Low Voltage Switchgear and Control Gear Standard; Part 8 – Control Units for Built-in Thermal Protection (PTC) for rotating electrical machines

Two-Speed Applications

Introduction

The Series B and later EC4 Current Monitoring Relay provides Parameter 88, 2-Speed FLA Set, for use in two-speed motor applications. This appendix provides overview and guidance on the various methods the E3 Plus can be employed to protect 2-speed motors.

External Control Applications

For applications in which the two-speed starter control is accomplished externally from the E3 Plus outputs, an auxiliary contact associated with the high speed contactor is wired to one of the E3 Plus inputs. The corresponding input assignment parameter (83 - 86) is set to “2-Speed”. The overload function’s thermal capacity utilized (TCU) calculation is based on the Parameter 88 setting when the 2-speed assigned input is asserted.

Output Control Applications

For applications that use the integral outputs of the E3 Plus, Out A is used to control the low speed contactor and Out B is used to control the high speed contactor. Control can be accomplished through commands transmitted by the network master or internal DeviceLogix function blocks. When Parameter 87, 2-Spd Net Enable, is set to “1” or “Enable”, the overload function’s thermal capacity utilized (TCU) calculation is based on the Parameter 88 setting when Out B is commanded closed.

Accessories

Table 66 - Accessories

Description	Used With	Cat. No.
Panel Mount Adapter	193-EC_B	193-ECPM1
	193-EC_D, 193-EC_Z	193-ECPM2
	193-EC_E	193-ECPM3
AC Input Interface Module	193-EC (all) 592-EC (all)	193-EIMD
Programming and Control Terminal	193-EC (all) 592-EC (all)	193-DNCT
Ground Fault Sensor (Core Balance Current Transformer)	193-EC3 (all) 592-EC3 (all)	193-CBCT1 193-CBCT2 193-CBCT3 193-CBCT4 193-CBCT5

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Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At <http://www.rockwellautomation.com/support/>, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://www.rockwellautomation.com/support/>.

Installation Assistance

If you experience an anomaly within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/support/americas/phone_en.html , or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

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